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ABSTRACT

This activity book serves as a primer on population dynamics and environmental impacts. It is designed to show young students their connections to other people, all living things, and the environment that surrounds them. While the kit is designed for use with students in grades 1-6, many of the activities are more appropriate for upper elementary students in grades 4-6. The book may be used as an entire curriculum or to select individual activities which fit curriculum priorities and teaching style. All of the activities are interdisciplinary, especially combining science, social studies, and math. Activity formats include games, simulations and role playing, lab studies, problem-solving challenges, cooperative learning activities, riddles, story analysis, library research, guided imagery, community service, and art projects. Each chapter begins with a teacher's introduction followed by a poem, song lyrics or excerpts from popular stories. All of the 41 activities outline the concept covered, student objectives, subject areas, skills used, materials needed, activity procedure, discussion questions, and follow-up ideas. A number of the activities contain teacher reproducible student worksheet masters. A concluding chapter includes word games which reinforce the concepts and vocabulary found in the activities. (LZ)

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COUNTING ON PEOPLE

Elementary Population and Environmental Activities

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COUNTING ON PEOPLE

Elementary Population and Environmental Activities

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A number of the activities in *Counting on People* were based on those developed by Earth People Associates for ZPG's *Elementary Population Activities Kit* in 1980. To all of the educators who worked on that creative team, we would like to express our appreciation for wonderful teaching concepts which have stood the test of time. Also, we would like to thank Susan Weber for her encouragement of this project and her commitment to helping raise population awareness among our next generation of leaders, voters and parents.

Finally, we wish to express our great appreciation to the Fred H. Bixby Foundation, Geraldine R. Dodge Foundation, The Huber Foundation and the David and Lucile Packard Foundation, without whose generous support *Counting on People* would not have been possible.

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COUNTING ON PEOPLE

TEACHER'S GUIDE

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TEACHER'S GUIDE

Welcome to *Counting on People*, an activity book that shows young students their connection to other people, all living things and the environment that surrounds them. The book not only serves as a primer on population dynamics and environmental impacts, but also fosters respect for the needs of others, and stresses the importance of each of us taking steps to live in harmony with the Earth that sustains us.

Global population growth, competition for scarce resources and environmental crises may seem like issues too complex for the elementary classroom. And yet, there are ways that young students can understand these concepts by drawing on personal experiences and by reaching out into their communities. *Counting on People* strives to make these issues come to life through memorable, informative and fun hands-on activities, stories and poems.

How to Use *Counting on People*

Counting on People is organized around concepts. Used as an entire curriculum, the book begins with the most basic understanding of what a population is and how it is measured. Students then learn how populations grow, what limits growth and how people are related to natural resource use, waste and other environmental issues. Finally, students gain an appreciation for our individual and collective responsibilities to protect the habitats of animals and people for present and future generations.

The book may also be used to select individual activities which fit your curriculum priorities and teaching style. All of the activities are interdisciplinary, especially combining science, social studies and math. Activity formats include games, simulations and role playing, lab studies, problem-solving challenges, cooperative learning activities, riddles, story analysis, library research, guided imagery, community service and art projects.

Each chapter begins with a teacher's introduction, suggesting ways to explain the chapter concept to students before beginning the activities. This is followed by a poem, song lyrics or excerpts from well-loved stories which capture the idea of the chapter in a thoughtful or whimsical way. All of the 41 activities clearly outline the concept covered, student objectives, subject areas, skills used, materials needed, activity procedure, discussion questions and follow-up ideas. A number of the activities contain student worksheet masters to be photocopied and distributed.

The concluding chapter contains word games which reinforce the concepts and vocabulary found in the activities.

While the kit is designed for use with students in grades 1-6, many of the activities are more appropriate for upper elementary students (grades 4-6). Even so, every chapter contains at least one activity for younger elementary students (grades 1-3). Grade levels are suggested, but each teacher must decide the suitability of the activity for their students based on their experiences.

We hope you and your students enjoy using *Counting on People* and that it stimulates further ideas for cultivating population and environmental awareness and responsibility among young people—our future generation of leaders, voters, parents and global citizens. Please feel free to address any comments or suggestions to: ZPG Population Education Program, 1400 16th Street, N.W., Suite 320, Washington, DC 20036; phone (202) 332-2200; fax (202) 332-2302.

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SUMMARY OF ACTIVITIES

ACTIVITY MODULES	DESCRIPTION	SUBJECTS	SKILLS
1. Everything Counts	Students measure wildlife populations of grass and beans using direct and indirect methods.	M, Sc, SS	Counting, multiplying, dividing, measuring, using basic formulas
2. People Count	Students conduct a census of households of their schoolmates, then chart and analyze the data.	SS, M	Conducting a survey, collecting and analyzing data
3. Millions and Billions	Through riddles, a demonstration and a short cooperative learning activity, students gain an appreciation of the meaning of large numbers such as millions and billions.	M	Counting, multiplying, dividing, metric measuring
4. Population by the Book	Students use easy-to-find reference materials, such as almanacs, encyclopedias, atlases and dictionaries, to find data on population and the environment.	LA, SS, Sc, M	Using library reference materials, reading charts and maps, drawing connections
5. Animal Arithmetic	Students complete a series of math games on the doubling of armadillo and mouse populations.	M, Sc	Adding, multiplying
6. Seeing Double	Students learn about exponential growth by solving riddles and observing the growth of a fruit fly population in a classroom lab activity.	M, Sc	Problem solving, multiplying, counting, observing
7. Pop Grows the Planet	Students prepare a timeline and participate in a simulation showing the history of world population growth.	M, Sc, SS	Multiplying, doubling, measuring in metric
8. Family Tree	Students simulate several generations of a family's growth, comparing a two-child and three-child average family size.	M, SS	Simulating, looking for patterns, making an elementary bar graph, critiquing models
9. Cougar Hunt	Student act as cougars in the wild trying to amass enough food to survive and learning about the carrying capacity of the land.	Sc, M, SS	Observing, understanding cause and effect, adding, role playing, using metric weights

SUMMARY OF ACTIVITIES

ACTIVITY MODULES	DESCRIPTION	SUBJECTS	SKILLS
10. Earth: The Apple of Our Eye	A dramatic visual demonstration illustrates the limits on farmland, making the importance of conservation clear.	SS, Sc, M	Dividing, observing, deductive reasoning, problem solving
11. The Stork and the Grim Reaper	A student simulation illustrates the relationships between birth and death rates and population growth within a finite space.	M, Sc, SS	Observing, deductive reasoning, researching
12. ZPG Island	From a card game, students learn about the meaning of *zero population growth*, birth and death rates, immigration and emigration, as well as the limits to growth.	SS, Sc, M	Using logic, role playing, understanding principles of cause and effect, supply and demand
13. When the Chips Are Down	In this game, students demonstrate characteristics of resource-rich and resource-poor countries and how competition and trade for these resources occur.	SS, M, Sc	Using basic abstract thought, role playing, understanding principles of cause and effect and supply and demand
14. Family Roots	By tracing the history of a family member or friend, students learn about the reasons why people migrate from one area to another.	SS	Using abstract thought, collecting and analyzing data, role playing, interviewing
15. From Island to Island	Students read (or have read to them) a short story about a group of people forced to migrate because of population pressures and resulting environmental problems. They discuss the story and act it out as a play or puppet show.	LA, Sc, SS, A	Reading and comprehension, drawing, role playing
16. Helping Hands	Students organize a school-wide event to help others in the community who need food, shelter, toys or other assistance.	SS, HE	Organizing, events planning, role playing, using abstract thought
17. Crowding Can Be Seedy	A simulation and gardening lab give students experience with the effects of increasing population density.	Sc, SS, M	Simulating, observing, collecting and analyzing data, basic gardening, understanding cause and effect

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SUMMARY OF ACTIVITIES

ACTIVITY MODULES	DESCRIPTION	SUBJECTS	SKILLS
18. Popumonsters	Two fun, physical games illustrate the clumsy and often inefficient operations of larger populations.	M, SS, PE	Coooperating, problem solving as a group
19. Open Spaces	Students estimate and verify the amount of space necessary to meet the oxygen needs of the entire class.	M, Sc, SS	Collecting and analyzing data
20. Energy Imagery	Through guided imagery, students compare their energy use with that of a Native American in the past and a child from India in the present. They then determine ways to conserve energy in their homes.	SS, Sc, HE	Imagining, making comparisons, prioritizing, practicing conservation techniques
21. Timber!	Through a role playing activity, students observe what happens to a forest when the demand for wood is greater than the supply.	M, Sc, SS, LA	Adding, subtracting, working in cooperative groups, interpreting data, poetry writing
22. Lessons from *The Lorax*	Students analyze the interdependencies demonstrated in a fictional Dr. Seuss story of rapid development in a formerly undisturbed environment.	Sc, SS, LA	Reading comprehension, story analysis
23. Every Drop Counts	Through three activities, students learn how much water is available for human consumption and how much water they use, both directly and indirectly.	Sc, M, HE	Estimating, data collecting, multiplying, dividing, brainstorming
24. Treasures Underground	Students learn about mineral use by matching common household items to their mineral components. They then "mine" chocolate chips out of cookies to understand the environmental impacts of mining operations.	Sc, SS, M	Drawing connections, using fine motor skills, brainstorming
25. Something for Everyone	In a game, students desiring to draw renewable resources from a common pool determine short-term consumption strategies that will preserve a long-term supply of the resource.	SS, Sc	Finding cooperative strategies, following directions

SUMMARY OF ACTIVITIES

ACTIVITY MODULES	DESCRIPTION	SUBJECTS	SKILLS
26. More or Less	Students construct a word web to show the possible cause and effect relationships of having "more people."	Sc, LA, SS	Drawing connections, understanding cause and effect relationships
27. Waste A-Weigh	By weighing and recording their waste at lunch each day for a week, students learn how conservation efforts can reduce the total amount of trash generated.	Sc, SS, M	Applying math concepts, measuring, practicing conservation, analyzing trends
28. Waste Not, Want Not	Students promote reusing and recycling items by hosting an event to collect throw-away items that can be used creatively for school projects.	Sc, SS, HE	Event planning, creative writing, brainstorming, recycling
29. Catching Pollution	Students "catch" pollution on prepared cards posted around town to see the consequences of relying heavily on cars, and to provoke thought about avoiding and/or reducing this dependence.	Sc	Observing, collecting and analyzing data
30. Habitat Is Home	Pictures facilitate discussion/awareness of the ways in which animal and plant habitats are being changed.	Sc, SS	Observing, using deductive reasoning
31. Pondering Pandas	A simulation of pandas in the wild relays to students the needs of the panda and the impact of population increase on their natural habitat.	SS, Sc, LA, M	Observing, role playing, researching
32. Wanted Alive	After being deputized "Species Sheriffs," students research an endangered species and create a poster defending the species' right to be saved.	Sc, A	Researching, writing, analyzing information, drawing

Subject Legend:

Sc = Science
SS = Social Studies
M = Math
LA = Language Arts
A = Arts
HE = Home Economics
PE = Physical Education

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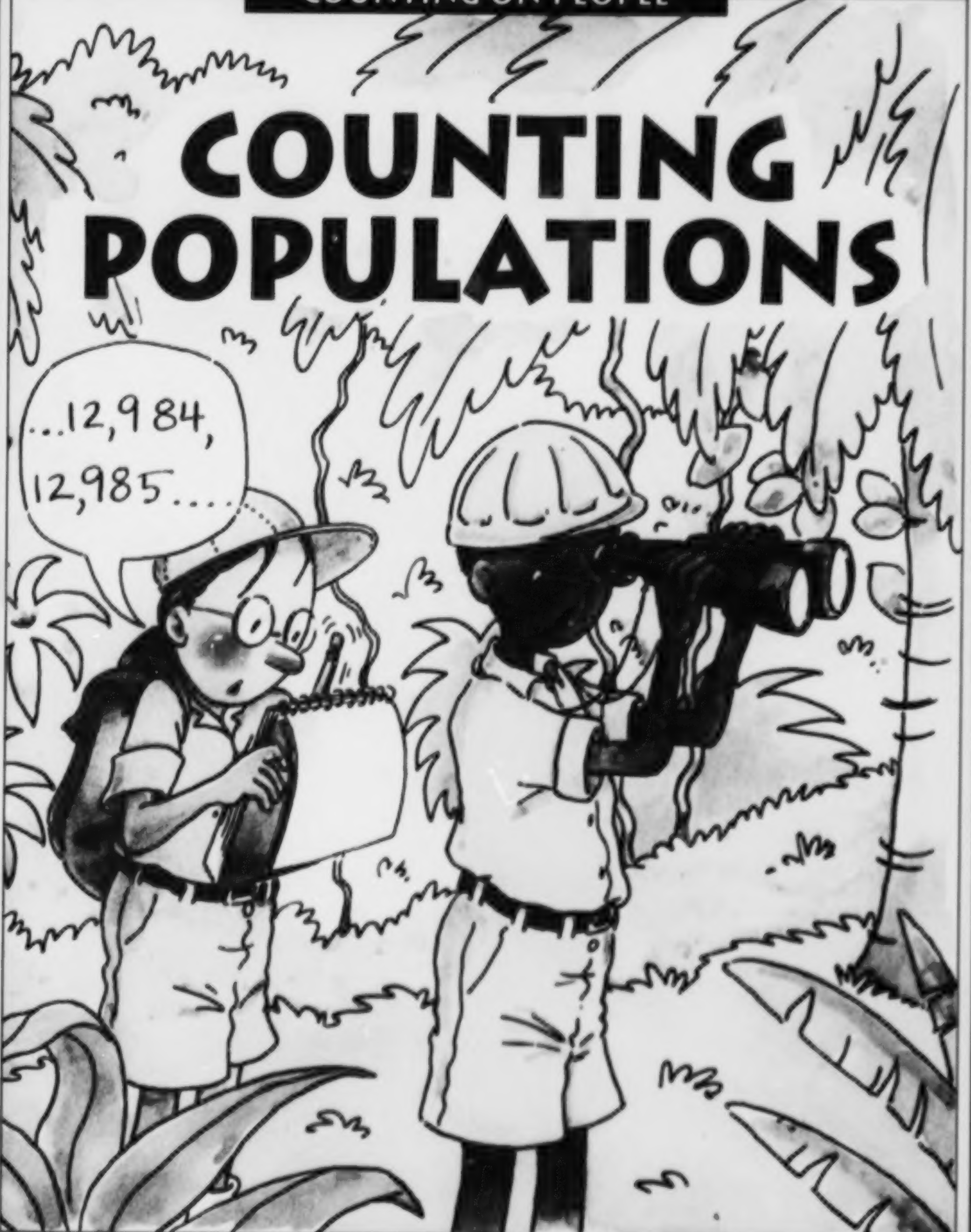
COUNTING POPULATIONS



WHAT IS A POPULATION?

The first few activities in this book help students understand what is meant by a "population," how we determine the size of a population, and whether that size can be considered large or small.

Before beginning these activities, go over the following information with your students:

> A **population** is a group of living things that are the same. They might live in the same area or be spread around the world. For example, your backyard may have a population of ants. That would be the entire group of ants living in your backyard. But there are ants all over the world, so the total number of ants is also a population. Some populations, like the worldwide population of ants, are just too big to count. Ants are very small and live in so many places. It is far easier to find out the population of koala bears. Most of them live in one country, Australia, and only in certain areas, or **habitat**, which have the kind of trees and climate that koalas need to live. Wildlife biologists, people who study plants and animals, have methods for counting all sorts of populations.
>
> People also make up populations. Your school population is all of the people who work and study in your school: students, teachers, librarians, secretaries, the principal, custodians, and the people who prepare food in the cafeteria. Your town has a population, as does your county, state, country and the world. You are a part of all of these populations.
>
> Some human populations are very much the same and others are very different. For instance, the population of your class would include kids who are all about the same age. But they look very different and like different things. The population of the world is even more varied than the students in your class. It includes people of all ages, races, religions and lifestyles.

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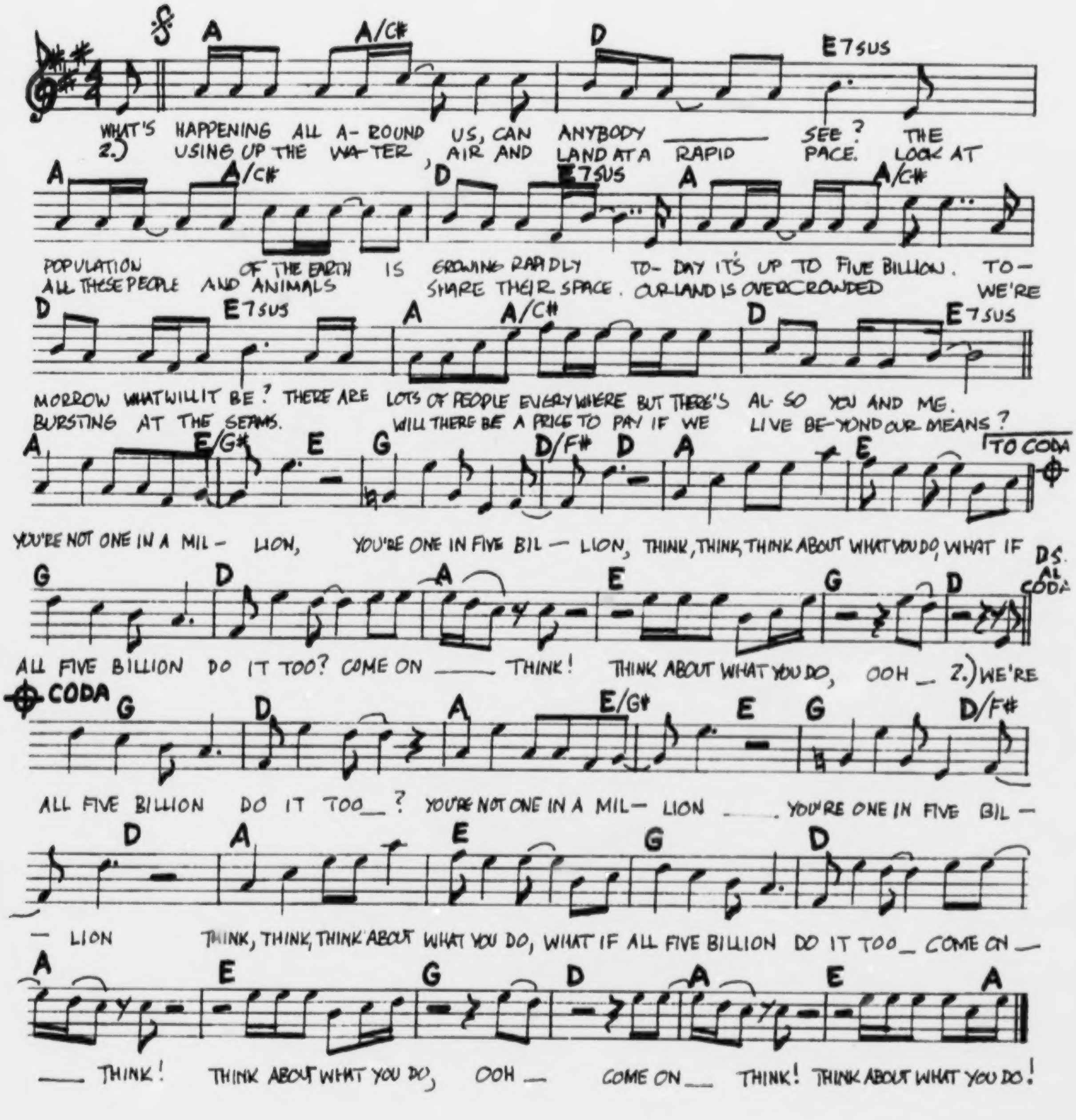
"You're One In Five Billion"

Words and Music by Susan Ring, Terry Blaine and Tommy DeSisto


A A/C# D E7SUS
WHAT'S HAPPENING ALL A- ROUND US, CAN ANYBODY SEE? THE
2.) USING UP THE WA-TER, AIR AND LAND AT A RAPID PACE. LOOK AT
A A/C# D E7SUS A A/C#
POPULATION OF THE EARTH IS GROWING RAPIDLY TO- DAY IT'S UP TO FIVE BILLION. TO-
ALL THESE PEOPLE AND ANIMALS SHARE THEIR SPACE. OUR LAND IS OVERCROWDED WE'RE
D E7SUS A A/C# D E7SUS
MORROW WHAT WILL IT BE? THERE ARE LOTS OF PEOPLE EVERYWHERE BUT THERE'S AL- SO YOU AND ME.
BURSTING AT THE SEAMS. WILL THERE BE A PRICE TO PAY IF WE LIVE BE-YOND OUR MEANS?
A E/G# E G D/F# D A E TO CODA
YOU'RE NOT ONE IN A MIL- LION, YOU'RE ONE IN FIVE BIL — LION, THINK, THINK, THINK ABOUT WHAT YOU DO, WHAT IF
G D A E G D D.S. AL CODA
ALL FIVE BILLION DO IT TOO? COME ON — THINK! THINK ABOUT WHAT YOU DO, OOH — 2.) WE'RE
CODA G D A E/G# E G D/F#
ALL FIVE BILLION DO IT TOO —? YOU'RE NOT ONE IN A MIL- LION —. YOU'RE ONE IN FIVE BIL —
D A E G D
— LION THINK, THINK, THINK ABOUT WHAT YOU DO, WHAT IF ALL FIVE BILLION DO IT TOO — COME ON —
A E G D A E A
— THINK! THINK ABOUT WHAT YOU DO, OOH — COME ON — THINK! THINK ABOUT WHAT YOU DO!

Ring/Blaine, ©1992 Sesame Street, Inc. and Poseidon Music, Inc. "You're One in Five Billion" is the theme song to *A Popular Little Planet*, a 3-2-1 Contact Video available from Sunburst, 1600 Green Hills Rd., Scotts Valley, CA 95067-0002.

EVERYTHING COUNTS

Concept: There are several ways to determine the size of a population.

Objective: Students will learn direct and indirect methods for measuring wildlife populations.

Grade Level: Upper elementary

Subjects: Math, science, social studies

Skills: Counting, multiplying, dividing, measuring, using basic formulas

Introduction: A population is the number of organisms of a given species which live in a given area at a given time. In other words, it is all members of the same species living in the same area at the same time. Some populations cannot be determined directly. So, indirect methods of counting have been devised to determine the size of populations of some kinds of living things. This activity will introduce students to some ways in which the size of a population is determined.

ACTIVITY 1

EVERYTHING COUNTS

Materials:

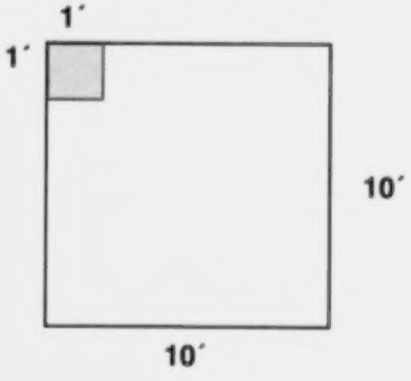
Lawn area and lawn markers
Measuring tape
Rulers
Pencil and paper
2 lbs. navy beans (100 beans for every 2 students)
Crayons
Plastic bags
Calculator (optional)

Preparation:

Select a lawn area large enough so that a pair of students each have a 10′ x 10′ (about 3 m x 3 m) area in which to work. Measure several 10′ squares and mark them with lawn markers (see illustration). Lawn markers can be made from popsicle sticks with small pieces of ribbon tied around them. Also count beans in lots of 100 and package them in small plastic bags or other containers. Each bag will be distributed to a pair of students working together.

Procedure:

PART 1: STEM COUNT (DIRECT METHOD)



Assemble students at the lawn area; assign two students to each 10′ x 10′ area. Have students mark off a 1′ (about 3 dm) square within the boundary of the larger square. Then have the student pairs count the number of grass stems within the small square. Note: count stems only; two or three leaves

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(blades) of grass may be growing from each stem. Record the number of stems. This is counting by the *direct method*. To find out the population of grass plants within the large square, multiply the recorded number by 100.

PART 2: WILD BEAN COUNT (INDIRECT METHOD)

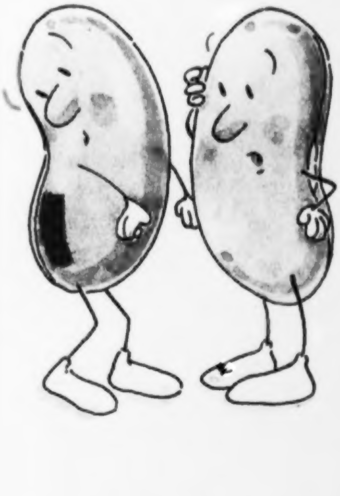
1. Before assembling the students, distribute groups of 100 beans as evenly as possible within each of the 10′ square. The beans represent a population of wild organisms in an environment. Do not reveal how many beans are in the plots.
2. Assign one student to each 10′ square. Explain that, when given a signal, they will have three minutes in which to locate and pick up as many beans as possible. The beans may be placed in plastic bags. Any bean outside the square should be disregarded and not picked up. Remind students that they are not competing against each other nor are they racing against the clock. Instead, they are simulating a method which population biologists use to count an unknown number of living things in a given area.

This method is known as the *Lincoln-Peterson Index*. It works like this: A sample of a population is collected from the environment. This sample is marked, then reintroduced into the same area. At a later date (when the marked individuals have mixed with unmarked individuals) another sample is collected. This time the entire population is again counted and recorded and the number of marked individuals is also recorded.

To find out the number of organisms (beans) in the area (the population) use this formula:

$$\frac{P}{M} = \frac{p}{m}$$

P = unknown population (which *you* already know to be 100)
M = individuals marked from the first sample
p = individuals collected in the second sample
m = number of marked individuals in the second sample



3. After students have collected the first sample and counted them, distribute crayons and ask them to place a color mark on one side of the bean. Then evenly redistribute the marked beans back into their respective squares.
4. Now instruct students to re-collect beans within the square for three minutes. Emphasize that any bean found within the square should be collected, not just the marked beans.
5. When the time has lapsed, ask students to count and record the total number of beans collected in the second sample and the number of marked beans recovered in the second sample.

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EVERYTHING COUNTS

6. Allow students to calculate the population of beans. For instance, if 85 beans were collected and marked in the first sample (M) and 79 beans were collected in the second sample (p), and if 69 of the 79 were marked (m), the formula would be:

$$\frac{\mathbf{P}}{85} = \frac{\mathbf{79}}{69}$$

Multiply: 85 x 79 = 6715

Divide: by 69

So **P** = 97 (Remember, the population of beans really is 100, but 95 and above is statistically acceptable. Note: Students may need assistance with the calculations.)

This method has been used to calculate the numbers of fish, waterfowl, rodents and other wildlife by wildlife scientists.

Discussion Questions:

1. Which method of counting seemed easier, direct or indirect? Which do you think is the more accurate? Which took more time?
2. What type of population would be easier to count using the direct method? What type of population might be easier to count using the indirect method?
3. Can you think of any factors that would make the *Lincoln-Peterson Index* ineffective in accurately determining the size of a population?
4. How might you *estimate* the population of students in your school? *Count the students in your class and find out how many classes there are in the school. Then multiply to get an estimate of the total student population.*

   How might you find the exact size of the school's student population? *You could count them, but it would be much easier to consult the principal or school office staff.*
5. Find out what the population is of your town or city. How do you think this was determined?

ACTIVITY 2

PEOPLE COUNT

Materials:

Student Survey (3 copies per student)
Student Worksheet (1 per student)
Colored pencils
Calculators (optional)

Procedure:

1. Tell students that they will be taking a census of the households of other students in the school. Using the student worksheet, they will be questioning 12 other students. For each person they select to survey, students must ask how many people live in the person's household (including themselves), and the age and gender (male or female) of each household member. This information will then be recorded on the Student Worksheet.
2. Make enough copies of the Student Survey sheet (master) for each student to have three copies. This will give them enough space to record data from 12 students. For each student questioned, they will record the student's name and the names, ages and genders of all household members (including themselves). Allow students two or three days to collect these data. To avoid just asking students in their own class, they may want to gather some of this data during lunch, recess, before or after school. That way, each student may have some different data.
3. After students have gathered their data, have them fill in the information on the Student Worksheet and answer the questions.

Note: Before beginning this activity, you may want to check with school administrators to see whether there is an approval policy in your district.

Concept: By taking a census, demographers determine the size and characteristics of a human population.

Objective: Students will conduct a census of the households of their classmates or other students in their school, then chart and analyze the data.

Grade Level: Upper elementary

Subjects: Social studies, math

Skills: Conducting a survey, collecting and analyzing data

Introduction: A **census** is a count of people in a given area or country. In the United States, a census is conducted once every 10 years to determine the country's population. In 1790, Thomas Jefferson directed the first census taken in the United States. The census was conducted by 17 U.S. marshals and their assistants who had to supply their own paper for the job! They found that about 4 million people lived in the United States. With over 260 million people to count in the United States today, the census is a bit more complex. Each household receives a survey of questions which must be filled out and returned. The answers are then tabulated. For this activity, students will conduct a simple survey of their schoolmates to determine certain characteristics of their households' population.

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PEOPLE COUNT

STUDENT SURVEY

NAME____DATE____________________

Use this sheet to conduct a census of 12 other students' households. You may gather this information from any 12 students in the school. Ask each student you survey the names, ages and genders (male or female) of all of the people living in their house including themselves. If a student does not want to participate in your census, ask someone else.

Name	Household Members (including self)	Age	Gender (Male/Female)
	1. 2. 3. 4. 5. 6.		
Name	Household Members	Age	Gender (Male/Female)
	1. 2. 3. 4. 5. 6.		
Name	Household Members	Age	Gender (Male/Female)
	1. 2. 3. 4. 5. 6.		
Name	Household Members	Age	Gender (Male/Female)
	1. 2. 3. 4. 5. 6.		

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PEOPLE COUNT

STUDENT WORKSHEET

NAME____________________________________ DATE__________________

Using the information from the surveys you conducted, fill in the chart below.

Age Group	Total Number	No. of Males	No. of Females
0-4			
5-9			
10-14			
15-19			
20-24			
25-29			
30-34			
35-39			
40-44			
45-49			
50-54			
55-59			
60-64			
65-69			
70-74			
75+			
All			

Which age/gender groups on your chart have the most people? ____________________

Which age/gender groups have the fewest people? ____________________

Imagine that all 12 households you gathered data for were located on the same city block. What types of businesses might do well if they opened in that neighborhood? (Hint: Think about the goods and services that this particular population would need.)

____

How do you think your chart might change if you surveyed the same people in five years? __________

____

Would there be another type of business that you might want to open in that neighborhood in five years? Explain. ________________________________

____

How does knowing the population help us plan to meet the needs of the population? __________

____

____

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MILLIONS AND BILLIONS

Concept: Millions or billions of people or things are large numbers. A million is a thousand times a thousand and a billion is one thousand times a million.

Objective: Through riddles, a demonstration and a short cooperative learning activity, students will gain an appreciation of the meaning of large numbers and, specifically, the difference between a million and a billion.

Grade Level:

Seeing a Million Stars (Lower elementary)

Big Riddles and *Measuring a Million* (Upper elementary)

Subjects: Math

Skills: Counting, multiplying, dividing, measuring in metric

Introduction: In 1994, there are 5.7 billion people living on Earth and 260 million people in the United States. Students often have difficulty understanding what is meant by such large numbers. They may not realize that one million is a thousand thousands and that one billion is a thousand millions. The following riddles and cooperative group activity will reinforce this lesson.

ACTIVITY 3

SEEING A MILLION STARS

Materials:

Optional: *How Much Is A Million?* by David M. Schwartz, illustrated by Steven Kellogg, New York: Scholastic Inc., 1985. Paperback: $3.95.

Procedure:

Younger students, especially, may have trouble conceptualizing a million or billion of anything. Try this activity to help them visualize one million. Draw 10 stars on a sheet of paper or use stick-on stars. Make 100 copies of this sheet on the photocopy machine. You now have 1,000 stars. Have students tape these 100 sheets around the room. Tell them that this is 1,000 stars. Tell students that they would need 1,000 rooms just like this to contain one million stars because one million is one thousand times one thousand. Other wonderful illustrations of the size of millions, billions *and even trillions* are found in *How Much Is A Million?* by David M. Schwartz with terrific pictures by Steven Kellogg. Here are a few highlights:

> "If one million kids climbed onto one another's shoulders, they would be . . . taller than the tallest buildings, higher than the highest mountains and farther up than airplanes can fly."
>
> "If a billion kids made a human tower . . . they would stand up past the moon."
>
> "If a goldfish bowl were big enough for a million goldfish . . . it would be large enough to hold a whale."
>
> "If you found a goldfish bowl large enough to hold a billion goldfish, it would be as big as a stadium."

In the back of the book, Schwartz explains all of his arithmetic. Kellogg's illustrations really make the math come alive for young and old alike.

MILLIONS AND BILLIONS

ACTIVITY 4

BIG RIDDLES

Procedure:

Try these riddles out on your students. For most students, you may want to have them simply guess or give estimates. For mathematically advanced students, you can have them figure out the exact answer.

1. Your rich uncle has just died and has left you $1 billion, with a catch. In order to accept the money, you must count it for eight hours a day at the rate of $1 per second. When you are finished counting the $1 billion is yours and then you may start to spend it.

   a. Do you accept your uncle's offer? Why or why not?

   No. It would take too long to count the money.

   b. How many years will it take you to count the money?

   Over 95 years.

2. a. If you spent $1 million at the rate of $1,000 per day, how long would it take you to spend it?

   1,000 days, or about 2 3/4 years.

   b. How long would it take to spend $1 billion at the same rate?

   1 million days, or 2,739.7 years.

3. a. How old do you think you would be if you were a million seconds old?

   About 11 days old.

   b. How old do you think you would be if you were a billion seconds old?

   About 31 years old.

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ACTIVITY 5

MEASURING A MILLION

Materials:

2 reams of paper (1,000 sheets)
Meter sticks (one for each group of four students)
Student Worksheets (1 per student)

Procedure:

Divide the class into groups of three or four. Have a representative from each group come to the front of the room and count out 100 sheets of paper for their group, and to collect a meter stick. Distribute the Student Worksheets which ask the students to complete the following assignments:

How tall would a million sheets of paper be? How about a billion sheets of paper?

Note: Answers may vary depending on the type of paper measured. A stack of 100 sheets of photocopy paper is approximately 1.3 cm high, so a stack of one million sheets is approximately 130 meters high and a stack of one billion sheets is approximately 130,000 meters (or 130 km) high.

Discussion Questions:

1. Can you think of anything that is about the same height as a million sheets of paper? How about a billion sheets of paper?

   A million sheets of copy paper would be about 130 meters high, or the height of a tall building over 40 stories. A billion sheets of paper would be over 72 miles high!

2. There are nearly six billion people on Earth. Is this a little or a lot? How does this compare with the 260 million people living in the United States?

   The world population is 23 times the size of the U.S. population. The United States is the third most populated country in the world.

4. If you lived in a city with a million people, what might there also be a million of?

   Answers might include houses, cars, televisions, chairs, tables, etc.

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MILLIONS AND BILLIONS

STUDENT WORKSHEET

NAME____DATE__________________

Problem: How tall would a million sheets of paper be? How tall would a billion sheets of paper be?

Process:

1. I would estimate that the height of a stack of a million sheets of paper would be _____ centimeters.

2. The average estimate for my group is ______ centimeters.

3. The height of 100 sheets of paper is ______ mm or _________ centimeters.

4. Based on the information in #3, the height of 1,000,000 sheets of paper is ______ mm or ______ cm or _____ meters. Remember: 1,000,000 = 100 x 10,000.

5. Based on the information in #4, the height of 1,000,000,000 sheets of paper is_________ meters.

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POPULATION BY THE BOOK

Concept: Population information for every part of the world is within easy reach. Finding comparative data helps students put population numbers in perspective.

Objective: Students use easy-to-find reference materials, such as almanacs, encyclopedias, atlases and dictionaries to find data on population and the environment.

Grade Level: Upper elementary

Subjects: Language arts, social studies, science, math

Skills: Using library reference materials, reading charts and maps, drawing connections

Introduction: The previous activities in this chapter explained to students what a population is, how it is measured, and how big large numbers are. Students will now translate this knowledge to understand real world data on population and the environment. With their interest in populations piqued, they will go on a scavenger hunt through common library reference books to find out about population size in their county, state, country and other parts of the world, plus facts on endangered species.

ACTIVITY 6

POPULATION BY THE BOOK

Materials:

The World Almanac by Funk and Wagnalls Corp., most current edition (multiple copies would work best if available)
Dictionaries
Set of illustrated encyclopedias (junior level or adult level)
World atlas (multiple copies would work best if available)
Student Worksheet (1 per student)
Tracing paper

(Note: A class trip to the school library is recommended for this activity. However, you may have some of this reference material on software programs. If so, you can choose to combine a library search activity with an activity on locating data by using a computer.)

Procedure:

1. All of the almanac questions on the Student Worksheet are answered in the *1994 World Almanac*. If using a more current edition, check through the book ahead of time to make sure all of the information is covered, and note page numbers so that you can check the students' work.

2. You may want to confer with your school's librarian before beginning this activity with your students. He or she can give you an inventory of reference materials appropriate for your students and may help you come up with additional questions for the Student Worksheet which can be answered by looking through other reference sources.

3. If students are not familiar with using an atlas or almanac, you may have to provide them with an orientation. Unlike an encyclopedia or dictionary, entries in the atlas and almanac are not arranged in alphabetical order. The index at the beginning of the almanac is listed alphabetically, but students will need to know which categories to look under. For questions 1-6, they will look in the index under "Population, U.S." and for questions 7-8, they will look under "Population, World." Answers to questions 9-10 are under "Endangered Species."

   The formats of atlases vary. An index should be in the front or back, listing all of the countries in alphabetical order. You may need to help students identify the topographical map for the question on rainforests.

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POPULATION BY THE BOOK

4. Divide students into pairs for locating the information in the school library and recording it on their worksheets. Allow two to three class periods for completion of this activity. Obviously, the more resource books available, the quicker this activity will go.

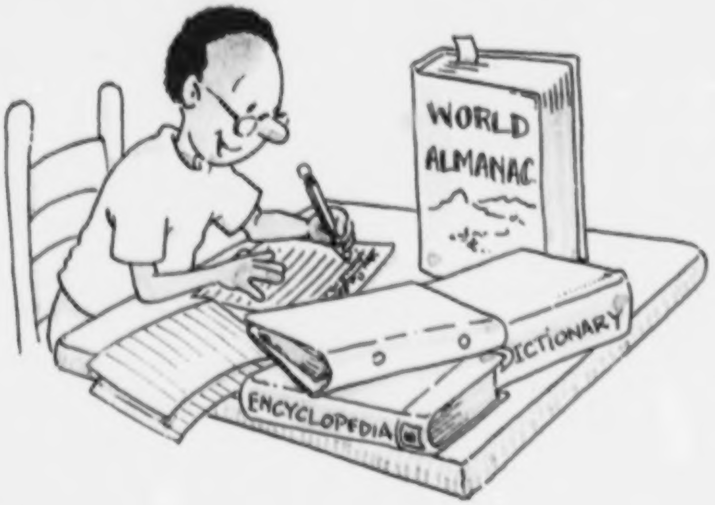
5. After students have completed the worksheets, go over them as a class and synthesize students' understanding of the lesson by leading them in the following discussion questions.

Answers to Almanac Questions on Student Worksheet:

1. California 2. Wyoming 3. Alaska 4. Rhode Island 5. Answers will vary 6. New York City, 7. 3 million people in the city and 19 million in the metropolitan area 7. China, India, U.S., Indonesia, Brazil 8. Tokyo, 27 million in the metropolitan area. Note: These answers are accurate as of 1994.

Discussion Questions:

1. Were you surprised by how many people live in our county? How about in our state or country? If you had more time, which other places would you want to look up in the almanac to determine their populations? Would you prefer to live in an area of the country with more people or fewer? Why?
2. What do you think it would be like to live in the most populated city in the world? How would your daily life be different than it is now? (List some ideas on the chalkboard.)
3. What do endangered species have to do with human population numbers? Were there many endangered species on the list in the almanac which are native to our area? What could we do to prevent many more species from becoming endangered in our area? (List these on the chalkboard.)
   Note: You could follow this activity with *Wanted Alive!*, an endangered species activity which appears later in the book.



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POPULATION BY THE BOOK

STUDENT WORKSHEET 1

NAME: ______________________________ DATE: ______________

Working in pairs, you will need to go on a scavenger hunt through the suggested library resources to find the answers to the following questions on populations and endangered species.

WORLD ALMANAC

For questions 1-6, look up "Population, U.S." in the index to lead you to the right charts. For questions 7-8, look under "Population, World." The answers for questions 9-10 will be found under "Endangered Species."

1. What is the most populated state in the country? ______________________________
2. What is the least populated state in the country? ______________________________
3. Which state has the most land area? Is it the same as the state with the most people? ______

____

4. Which state has the smallest land area? Is it the same as the state with the fewest people? __

____

5. What county do you live in? What is the area and population of your county? __________

____

6. What is the largest city in the United States? How many people live there? __________

____

7. What are the five most populated countries in the world? ______________________

____

____

8. What is the world's largest city? How many people live there? ______________________

____

____

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POPULATION BY THE BOOK

STUDENT WORKSHEET 2

Now let's look up some information on a different topic—endangered species. As human populations grow, they often take up land that was habitat (living space) for certain plants and animals. If these species are left with no other place to go, their numbers often drop. You will be using the almanac, encyclopedia and dictionary to answer the following questions about endangered species.

In the almanac, look at the chart listing "Some Endangered Species." List three mammals and three birds from the list. ____________________

____

____

Look at the entire list again. Are any of the species listed native to the area where you live? If so, which ones? ____________________

____

____

____

DICTIONARY

Using a dictionary, find and write down the definitions for the following words.

Endangered ____________________

____

____

Resource ____________________

____

____

Population ____________________

____

____

Habitat ____________________

____

____

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POPULATION BY THE BOOK

STUDENT WORKSHEET 3

ENCYCLOPEDIA

Using encyclopedias, find a picture of one of the endangered species you identified in the almanac and trace it onto tracing paper. In the atlas, you identified the five most populated countries in the world. Look up one of them in the encyclopedia and write down five facts about that country.

1. ____
2. ____
3. ____
4. ____
5. ____

ATLAS

Find in the atlas the country that has the most people (from your answer to #7 under the almanac questions). Write down the page number and the country's capital.

Some countries contain tropical rainforests. Tropical rainforests are home to most of the world's plant and animal species and these forests help control the world's climate and help clean the air. On a topographical map (shows forests, mountains, deserts, etc.) of the world in the atlas, find the countries which contain tropical rainforests. Are any of these countries the same ones which have the most people? ____________________

____

____

Find the world's largest city in the atlas. What country is it in? What continent? ________

____

____

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HOW POPULATIONS GROW

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HOW DO POPULATIONS GROW?

Once students understand what a population is, they can learn how populations grow. The activities in this chapter show that many populations grow very quickly. The concept of **exponential growth** is demonstrated as students observe the growth of a fruit fly population, trace the growth of an armadillo population and learn about the history of human population growth.

Before beginning these activities, go over the following information with your students:

> All living things have the ability to reproduce themselves so that the population continues into the future. Plants produce seeds to make more plants, and animals and people give birth to babies, or offspring. Some animals produce one offspring at a time; others produce many, as when cats and dogs have litters of kittens and puppies. This is known as **biotic potential**. Dogs and cats may have several litters of up to 10 offspring in each litter. Still, they have a lower biotic potential than fish which lay hundreds of eggs, spawning many little fish. An elephant has a lower biotic potential than cats, giving birth perhaps only a few times to a single offspring each time.
>
> The world is not overrun with fish or other animals with a high biotic potential because many have a short lifespan. They are eaten by other animals, or die from a change in climate, lack of food, or disease. There are many limits to the growth of different animal and plant populations.
>
> Because humans are the most advanced of all animal species, our population has grown differently. Many years ago, most humans had large families, but most people lived short lives. Life was very different for people than it is today. People had to hunt for their food or grow their own; there were no supermarkets. People often died of common diseases like the measles; there was no modern medicine like penicillin. Over many years, people discovered ways to live longer lives with more comforts. Modern transportation brought people and ideas together. In effect, people learned how to remove some of the limits to population growth.
>
> In some parts of the world, people today have smaller families, but in some parts of the world people still have large families. Because there are many more people being born around the world than there are people dying, the population grows. Within the past 200 years, the population has increased six times. That is, the population went from one billion (1,000,000,000) in the year 1810 to nearly six billion today. The human population continues to grow.

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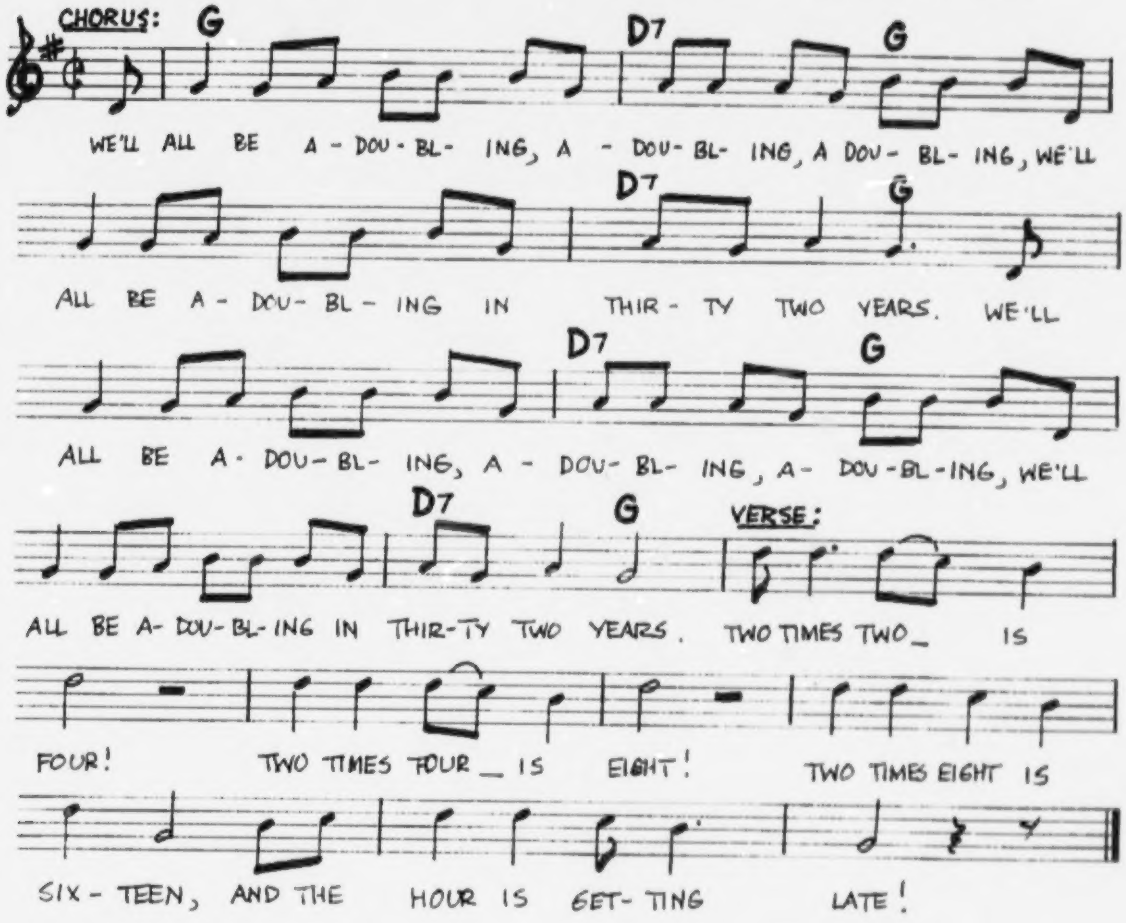
We'll All Be A-Doubling

Words by Pete Seeger (1965); Music: traditional ("The Old Ark's A-Movering")


CHORUS:
G
D7
G
WE'LL ALL BE A - DOU - BL - ING, A - DOU - BL - ING, A DOU - BL - ING, WE'LL
D7
G
ALL BE A - DOU - BL - ING IN THIR - TY TWO YEARS. WE'LL
D7
G
ALL BE A - DOU - BL - ING, A - DOU - BL - ING, A - DOU - BL - ING, WE'LL
D7
G
VERSE:
ALL BE A - DOU - BL - ING IN THIR - TY TWO YEARS. TWO TIMES TWO _ IS
FOUR! TWO TIMES FOUR _ IS EIGHT! TWO TIMES EIGHT IS
SIX - TEEN, AND THE HOUR IS GET - TING LATE!

Chorus (and after each verse):
We'll all be a-dou-bl-ing, a-dou-bl-ing, a-dou-bl-ing,
We'll all be a-dou-bl-ing in thirty-two years.*

2.Twice sixteen is thirty-two
Next comes sixty-four
Next a hundred and twenty-eight
Do we need to hear more?

3.Next is two hundred fifty-six
Next five hundred and twelve
Next one thousand and twenty-four
So figure it out yourself.

4.Keep doubling ten generations
You can have children over a million
Keep going another twenty
Your children would be over a trillion.

5.Give it another three hundred years,
Your children number a billion;
Keep doubling another millenium
You can have another quadrillion.

6.Either people gonna have to get smaller
Or the world's going to have to get bigger;
Or there's a couple other possibilities,
I'll leave it to you to figger.

TRO - ©1970 Melody Trails, Inc., New York, NY. Used by permission.

*Note: When Pete Seeger wrote this song in 1965, the population doubling time was 32 years. As of 1994, the population doubling time is 41 years.

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ANIMAL ARITHMETIC

Concept: All living things have the ability to reproduce, thus perpetuating (and potentially increasing) the population of that species.

Objective: Students will become acquainted with the concepts of doubling time, exponential growth and biotic potential by completing a series of math games.

Grade Level:

Adding Armadillos (Upper elementary)

Multiplying Mice (Lower elementary)

Subjects: Math, science

Skills: Adding, multiplying

Introduction: Each kind of living thing has a biotic potential, the ability to increase its numbers through reproduction. Large animals, such as elephants or humans, have a low biotic potential, as they produce only a few young during a lifetime. Many smaller animals and most plants have a high biotic potential. For instance, a tree may produce thousands of seeds a year and a frog can lay hundreds of eggs.

ACTIVITY 7

ADDING ARMADILLOS

The nine-banded armadillo of North and South America is a peculiarly armored mammal with some rather peculiar habits. Armadillos live about four years in the wild. They mate after the first year and produce one litter a year. In each litter, four offspring of the same sex are born.

Materials:

Student Worksheets (1 per student)
Reference material on armadillos (suggested)

Procedure:

Distribute copies of the Student Worksheets and have students complete Tasks A and B. *Answers: 12; 126*

Discussion Questions:

1. If armadillos multiply so rapidly, why isn't the world overrun with armadillos? What might stand in the way of the armadillo population growing as it does in the simulation?

   There are limiting factors which keep a population from growing indefinitely. Many animals are eaten by other animals or die from diseases or lack of available food, or because of changes in the weather or local environment.

2. Although humans have a much lower biotic potential than armadillos, our population continues to grow steadily. What is different about the survival of humans?

   Humans are the most sophisticated animal species. We have few predators and we have found many ways to fight common diseases, grow food and survive in different climates.

3. In order for the human population to be stable and not grow or decline, what would be the average number of children each couple could have during their lifetimes?

   Two. This would mean each couple would replace themselves.

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ANIMAL ARITHMETIC

ADDING ARMADILLOS STUDENT WORKSHEET 1

NAME ______________________________ DATE ______________

TASK A:

A male and female armadillo (Mamadillo and Papadillo) mate one time each year. Each time, Mamadillo gives birth to four babies. At the end of three generations, how many armadillos would Mamadillo herself have given birth to?

Fill in the blanks and add to get the total number of offspring.

(Number of young in first litter)

(Number of young in second litter)

(Number of young in third litter)

ANSWER

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ANIMAL ARITHMETIC

ADDING ARMADILLOS STUDENT WORKSHEET 2

NAME ______________________________ DATE ____________

TASK B:

Assuming that the offspring of the first two generations lived and each of them produced litters and all of those offspring lived too, what would the total population of armadillos be after three generations?

Fill in the blanks and add all members of the armadillo family to get total population at the end of three generations. This total number will be all the offspring produced during Mamadillo's and Papadillo's lifetime, plus Mamadillo and Papadillo themselves. Each block represents a litter of four.

	New Offspring	+Total Alive From Last Year	Total Alive	Year
Originally, there are ___ armadillos, Mamadillo and Papadillo.	0	0	2	Year 0
Mamadillo gives birth to ____ offspring.				Year 1
Last year's offspring have 4 offspring each for a total of ____ and Mamadillo and Papadillo have another ____.				Year 2
Last year's offspring each have 4 offspring for a total of ____, and Year 1's offspring each have 4 offspring for a total of ____, and Mamadillo and Papadillo, being armadillos, have their last litter of ____.				Year 3

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ANIMAL ARITHMETIC

ACTIVITY 8

MULTIPLYING MICE

Materials:

Large sheet of chart paper
Ink pad or finger paints
Moistened towelettes

Procedure:

Here's a version of the activity for younger students. On a large piece of chart paper, copy the chart provided for showing how the mouse population grows. Have students make thumbprint mice with finger paints or ink pads to represent the mice. Have students come up to the front of the room one at a time to contribute their thumbprints to the mouse family tree. It's a good idea to have moistened towelettes for cleaning off student hands after this exercise. Give the students the following instructions:

"Let's see how the numbers of mice can grow. A pair of field mice can have a litter of six baby mice every three weeks (21 days). The young mice are soon ready to raise their own families.

Put two thumbprints in the first box to represent Mama Mouse and Papa Mouse. They have six baby mice. Put six thumbprints in the next box. Label half of these mice "B" for boy and the other half "G" for girl. Three weeks later, the babies have their own babies. Each of the girl mice has six babies. How many is this? Put thumbprints in the next box to represent those babies. Continue making six prints for every female in the previous box and marking half "B" and half "G". At the end of every box, write the total number of mice (boys and girls)."

*Adapted with permission from the activity, "Rat Babies," by Elaine Hampton, 735 Lamar, Las Cruces, NM 88051.

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ANIMAL ARITHMETIC

MULTIPLYING MICE

Copy the chart below onto large butcher paper and tape up to the wall. Have students add their thumbprints according to the earlier directions.

<table>
<tr><td>Mama and Papa Mouse</td><td>Baby Mice (3 Weeks later)</td></tr>
<tr><td colspan="2">(3 Weeks later)
TOTAL 24</td></tr>
<tr><td colspan="2">(3 Weeks later)
TOTAL 96</td></tr>
<tr><td colspan="2">(3 Weeks later)
TOTAL 384</td></tr>
</table>

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SEEING DOUBLE

ACTIVITY 9

DOUBLING RIDDLES

Materials: None

Procedure:

Try these doubling riddles out on your students and encourage them to test them out on their families and friends.

1. You are a lily pad on a pond. Today you have only one fellow lily pad living on the pond with you. But your population is growing. Its doubling time is one day. So every day the population is twice as big as the day before. Tomorrow there will be four of you. It will take exactly 20 days for your pond to be completely full of lily pads.

   On what day will the pond be one-half full?

   Day 19

   Do you think you and your fellow lily pads will feel concerned on that day about running out of space? Why or why not?

   Perhaps not. With only half the space taken, the lily pads may feel that they still have plenty of room to expand.

   How will the pond filling up affect you and your fellow lily pads?

2. A father complained that his son's allowance of $5 per week was too much. The son replied, "Okay, Dad. How about this? Let's change my weekly allowance for one month using this rule: You give me a penny on the first day of the month, two cents for the next, four cents for the next, eight cents for the next, and so on for every day of the month." The father readily agreed. Who was the more clever? What would be the son's allowance on day 31?

   The son was the more clever. His allowance on day 31 alone is $10,737,41 8.24. This does not count how much he received on all the previous days. This is a good example of how doubling even a small amount over time can really add up.

Concept: Populations can grow exponentially, continuing to double.

Objectives:

a. In solving some riddles, students learn about exponential growth.

b. Students observe exponential growth of a fruit fly population.

Grade Level: Upper elementary; Follow-up Activity is appropriate for lower elementary also.

Subjects: Math, science

Skills: Problem solving, multiplying, counting, observing

Introduction: Populations often grow exponentially, doubling over and over until a very small amount becomes a very large amount. The following activities will help students better understand this growth pattern. The riddles illustrate the "power of two" and the fruit fly lab gives a hands-on demonstration of the exponential growth of an actual population of organisms.

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SEEING DOUBLE

ACTIVITY 10

FRUIT FLY FRENZY

Students will get to observe exponential growth of a living organism first-hand in this fruit fly lab. Because ether is used to anesthetize the fruit flies for counting, you may want to demonstrate this for students at the front of the class. For older students, you can divide them into groups and have each group conduct the lab with their own set of fruit flies.

Materials:

Fruit flies (order from a science lab supplier)
Mashed banana
Baby food jars
Ether (order from a science lab supplier)
Cotton gauze
Piece of muslin
Paper towel
Graph paper

Procedure:

1. Prepare a home for fruit flies by placing either some mashed banana in the bottom of a baby food jar. You may be able to attract fruit flies from your school surroundings into this jar or you can order them from a supplier. Start the jar with a small number of fruit flies. Cover your jar with a piece of muslin to allow air into the jar.
2. Have students copy the "Fruit Fly Population Counts" chart into their notebooks. For Day 1 they will record the number of fruit flies in the jar at the start of the lab. They will then make population counts every day for four weeks.
3. In order to count the flies, you will need to anesthetize them. Wet cotton gauze in ether and hold the gauze over the top of your fruit fly jar. **Do this in a well ventilated area.** Watch the flies carefully. Do not expose them too long to the ether. As soon as their motion stops, remove the gauze and dump the flies onto a paper towel to count them. Return them quickly to the jar, as the flies will soon revive from their sleep.
4. Have students record the counts on their charts and make a graph of the population growth. What is the shape of the graph?

Discussion Questions:

1. Why is it impossible for the fruit fly population to increase in size forever in the system you have set up?

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SEEING DOUBLE

There is a limited amount of food and space for the fruit fly population.

2. What do you think might happen to the fruit flies if the population continues to grow?

   Fruit flies will eventually begin to die if the population grows too large with limited amounts of food and space.

3. Could any population continue growing forever on Earth? Why or why not?

   No. There are limits to how large any population can grow, such as food shortages, disease, predators and climate.

Fruit Fly Population Counts

Day	Number	Day	Number
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

*Adapted by permission from Joni Keating as included in *Is There Room For Me? The Growth and Regulation of Populations*, Good Apple, Inc., ©1981.

Follow-up Activity:

An excellent visual and musical illustration of exponential growth is found in the Disney classic, *Fantasia.* With Mickey Mouse's magic out of control, the number of dancing brooms continues to double to the tune of "The Sorcerer's Apprentice." The videotape is available for rent in many video stores. For a memorable, interdisciplinary lesson, show this portion of *Fantasia* to combine math, music and fun. This is also an excellent way to explain the "power of two" to younger elementary students.

POP GROWS THE PLANET

Concept: Over the past few hundred years, the human population has grown exponentially, creating a "population explosion."

Objective:

a. In *Doubling on the Line*, the class will prepare a timeline which graphically portrays population doubling through history.

b. In *Population Circle*, students will demonstrate exponential growth as they simulate world population history.

Grade Level: Upper elementary

Subjects: Math, science, social studies

Skills: Measuring in metric, multiplying, doubling numbers

Introduction: At one time, before people knew how to prolong life with modern medicine, better nutrition and sanitation, the human population grew very slowly. While there were many people being born, there were also many people dying. In modern times, we have found ways to prevent so many people from dying young, but there are still many people being born. Because there are more births than deaths in the world each year, the population grows. Even a small population growth rate can cause the population size to double in a short time.

ACTIVITY 11

DOUBLING ON THE LINE

Materials:

1 roll of adding machine tape per class (the tape should be cut into 7-meter strips; one for each group of three or four students)
3 or 4 colored felt tip markers per group of four students
1 meter stick for each group of four students

Procedure:

1. Divide the class into groups of three or four. Distribute the meter sticks, a 7-meter piece of adding maching tape and the colored markers to each group.
2. Explain to the class that you are going to provide data which show how the world population has been growing from the year 1500 to the present time and projected to the year 2020.
3. To construct a timeline which depicts the length of each doubling in the total world population, students should use this scale: *every 10 years is equal to one decimeter; every meter equals 100 years*. Have the class mark their tape at every decimeter and count by thousands or hundreds of years to pinpoint the doubling times on their tapes. The years should also be recorded on the tapes.
4. Ask students to color each section representing a doubling time a different color for greater contrast.

World Population Growth Data Chart

Year	World Population		
1550	500 million	or	1/2 billion
1810	1,000 million	or	1 billion
1927	2,000 million	or	2 billion
1975	4,000 million	or	4 billion
2020*	8,000 million	or	8 billion

* projected

Doubling Time			Length of Tape
#1	(1550 - 1810)	260 years	2.6 meters
#2	(1810 - 1927)	117 years	1.17 m
#3	(1927 - 1975)	48 years	0.48 m
#4	(1975 - 2020)	45 years	0.45 m

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ACTIVITY 12

POPULATION CIRCLE

Materials:

Chalk
Bell or gong
Stopwatch or watch with a second hand

Procedure:

1. Draw a chalk circle on the floor about six feet in diameter. Yarn or tape may also be used to mark off the circle.
2. Ask two students to stand in the circle to represent the world's population in the year 1550, and have more students enter the circle according to the table below. (Note: If you don't want to wait 3 minutes and 20 seconds for the first interval, you could begin the simulation in the year 1750 with three people in the circle.)
3. Each student represents 250 million people (approximately the U.S. population in 1990). Each second represents one year. If there are more than 20 students, make each student represent fewer people. For example, if one student equals 100 million people, you would need about 50 students.
4. One person should be responsible for informing the group about the passage of years, the world population in numbers and the intervals in years. Be dramatic! Use a bell or gong for each new time span.

Year	**World Population** (in millions)	**Total in Circle** (1=250 million)	**Interval To Next Date**	**Add Participants** at end of this simulation interval	**Add to Circle**
1550	500	2	200 yrs	3 mins., 20 secs.	1
1750	750	3	60	1 min.	1
1810	1,000	4	80	1 min., 20 secs.	2
1886	1,500	6	41	41 secs.	2
1927	2,000	8	22	22 secs.	2
1950	2,500	10	10	10 secs.	2
1960	3,000	12	15	15 secs.	4
1975	4,000	16	12	12 secs.	4
1987	5,000	20	12	12 secs.	4
1999*	6,000	24			

*projected

Follow-up Activity:

Put the following questions on the chalkboard: "Can the Earth's population go on doubling forever?" List students' reasons on the board. You may want to prompt them by asking them to think about food supply, clean water, homes, forests, wildlife and competition for resources.

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Concept: Average family size determines how a population grows.

Objective: Students simulate several generations of a family's growth, comparing a two-child and three-child average family size.

Grade Level: Upper elementary

Subjects: Math, social studies

Skills: Simulating, looking for patterns, making an elementary bar graph, critiquing models

Introduction: Small differences can add up quickly where population growth is concerned. A population with a higher average family size produces larger numbers of people over time than a population with a smaller average family size. This activity shows what a difference a two- versus three-child average family size can make over time.

ACTIVITY 13

FAMILY TREE

Materials:

A set of wide steps (bleachers work well)
Minute timer
Bags of candy
4 signs: "Age 0-19"; "Age 20-39"; "Age 40-59"; "Age 60-100"
10 small plastic bags (for Follow-up Activity)
Bag of dry beans or macaroni (for Follow-up Activity)
Student Worksheet (1 per student)

Procedure:

1. Tell the students that this activity is designed to show the importance of average family size. Explain that a large average family size can result in a significant increase in population over time. Point out that many different family sizes can result in an average size of two children per family. For example, one couple may have three children, one couple four children, one couple one child and one couple none, but the average of these four families is two children.
2. Using wide steps or bleachers in a gym or outdoors, label the bottom step "Step 1: Age 0-19," the second step "Step 2: Age 20-39," the third step "Step 3: Age 40-59," and the fourth step "Step 4: Age 60-100." If no bleachers or steps are available, you can substitute rows of auditorium chairs or just place the signs along one wall.
3. Ask four students to stand on Step 1. They will represent two couples. Explain that in this simulation, one minute will represent 20 years and each student will start his or her life when two others decide that he or she should be "born." After the first minute, have the two couples move up to Step 2 (Age 20-39) and select three students each to represent their children. They will stand on Step 1. The children from one couple will eventually pair up with the children from the other couple.
4. After the next minute passes, the original couples will move up to Step 3 (Age 40-59) and have their "children" each select spouses from the other students on their step. (So, the children from couple #1 might select spouses from the children of couple #2.) Each of those couples must now select three students each to stand on Step 1 to represent their children.
5. Continue the simulation as follows. After each 20-year (one-minute) interval, everyone should move up one step:

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FAMILY TREE

a. Those aged 20-39 on Step #2 should select spouses, link arms, and together choose three new children. (When an odd numbers occurs on this step, one person will proceed through the activity singly.)

b. Those aged 40-59 on Step #3 receive a bag of candy, contribute some to the other people in their family to pay for their education and medical care, and put the rest on Step #4 for their retirement.

c. Those aged 60-100 on Step #4 can eat any candy they put away for retirement, then "die" and return to their seats.

d. Those selected to be born should stand in front of their parents on Step 1.

Note: If you have fewer than 45 students, have them place pieces of paper or books on Step #1 to represent their children. Or, you can go through four generations only, requiring 31 students.

6. After the simulation has gone on for five generations, count the number of people on each step, and make a bar graph. Count the number of people who have died. What is the total number of people who either were on the steps at the end or passed through them during the activity? What is the largest number that were ever on the steps?
7. Begin the simulation again, but this time have each couple choose two "children" to be born.
8. After five generations, tally the number of people on each step, make a bar graph, and count the number of people who "died." How do these figures compare to the first simulation?

Discussion Questions:

1. Do you think there are a lot of situations where families follow either of these models? Why not?
2. What difference would it make if millions of couples decided to have three children instead of two?

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FAMILY TREE

Three-child Family: Number of students on each step

	Step 1	Step 2	Step 3	Step 4
Beginning of simulation	4	0	0	0
After 1 minute	6	4	0	0
After 2 minutes	9	6	4	0
After 3 minutes	12	9	6	4
After 4 minutes	18	12	9	6

Two-child Family: Number of students on each step

	Step 1	Step 2	Step 3	Step 4
Beginning of simulation	4	0	0	0
After 1 minute	4	4	0	0
After 2 minutes	4	4	4	0
After 3 minutes	4	4	4	4
After 4 minutes	4	4	4	4

Follow-up Activity:

Another interesting way to illustrate the impact of a two-child family average compared to that of a three-child family average if continued over a number of generations is to use dry kidney beans or macaroni. Distribute copies of the Student Worksheet. Have the students prepare a series of small plastic bags containing beans to represent the number of children in succeeding generations of families. Have one group construct a series for a two-child family and one group do a three-child family. Variations can include extending the number of generations to see how quickly numbers mount up or demonstrating what happens with families of larger average size.

Answers to Follow-up Activity

	No. of Beans 2-child family	*No. of Beans 3-child family*
Generation 1	*2*	*2*
Generation 2	*2*	*3*
Generation 3	*4*	*9*
Generation 4	*8*	*27*
Generation 5	*16*	*81*

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FAMILY TREE

STUDENT WORKSHEET

NAME______________________________________DATE ______________

In this brief lab, you will find what the difference would be over many generations of a two-child family average and a three-child family average.

1. Prepare a plastic bag with two beans to represent parents.
2. Prepare a second bag to represent the offspring in a two-child family (2 beans). This is the second generation of beans.
3. Prepare a third bag to represent the grandchildren of generation one (4 beans). Continue preparing bags for two more generations of beans and complete the chart below.
4. Assume your beans live for three generations. How many beans will you have "alive" at the end of the activity?
5. Assume a four-generation life span. How many beans will you have alive?
6. Repeat the activity and complete the activity for a three-child family pattern.

	No. of Beans 2-child family	No. of Beans 3-child family
Generation 1	2	2
Generation 2		
Generation 3		
Generation 4		
Generation 5		

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HOW MANY IS ENOUGH?

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HOW MANY IS ENOUGH?

The past chapter examined how populations grow. It is important for students to understand that populations cannot continue to grow indefinitely. Every ecosystem has a **carrying capacity**, the maximum number of members of a species that can be supported by the finite resources of that area. In this chapter, students will learn that finite resources create a carrying capacity for animals and people.

Before beginning these activities, go over the following information with your students:

> What would happen if the population of your class continued to grow but remained in the same classroom? Do you think there is a limit to the number of students your classroom could hold comfortably? If your class grew even by just a few students, there may not be enough desks, chairs and school supplies to go around. Your class has a **carrying capacity**, the largest number of students that your classroom could hold and still allow your teacher to conduct class with everyone having desks, chairs and supplies.
>
> Think of a wooded area which is home to deer, rabbits and squirrels. There is only enough food to be found for so many animals. If the populations of these animals grow too much, some may have to leave to find other food and shelter. The wooded area has a carrying capacity. It can only support so many animals.
>
> The world also has a carrying capacity for humans. People need all sorts of things to live: food, water, shelter and fuel. For these things, we need to use land to grow crops, cut down trees for buildings and mine the ground for oil, coal, natural gas and minerals. There is a limit to how much food and how many trees can be grown and how much we can mine from the ground. If the population of people continues to grow, there will not be enough of these things, or **resources**, to go around.
>
> Think about your classroom again. You may be happiest if the class size does not grow. That way, you have more space around your desk, get to ask and answer more questions in class and get to know your classmates and teacher better. You may not want the population of your class to grow to the carrying capacity. It is the same in your town, country and in the world. The best population size may not be the biggest, but one in which everyone has plenty to eat, open space to enjoy, a nice, safe place to live and many friends.

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Carrying Capacity
('Nough Said)

What if five plants sprouted
In a tiny pot for one?
Would all the roots get tangled?
Would some not get the sun?

What if fish by the hundreds
Were dumped in a pond in a bunch?
Would they get bumped while swimming?
Would they eat their friends for lunch?

What if twenty people came
To a dinner planned for four?
Would there be stomachs growling?
Would some eat on the floor?

There always is a limit
To space and food and stuff.
And we can share, but sometimes, well,
There just is not enough!

by Deborah Brouse

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COUGAR HUNT

Concept: Every piece of land has a limited carrying capacity for the number of animals and/or humans it can support.

Objective: Students will gain a better understanding of what is meant by carrying capacity when they act as predatory animals in a finite area and attempt to accumulate enough food to stay alive.

Grade Level: Upper elementary

Subjects: Math, science, social studies

Skills: Observing, understanding cause and effect, adding, role playing, using metric weights

Introduction: It's been said that every person on the planet, all 5.7 billion of us, could fit into the state of Texas. But being able to fit a certain number of people into a space doesn't mean they'd be able to live there for any length of time. We need more than just a certain amount of space to survive; we need things like food and water. There isn't enough farmland or drinking water in Texas, or in all of North America, for that matter, to support 5.7 billion people. Texas, the United States and the planet all have limits to how much they can give to support people. Every habitat does.

ACTIVITY 14

COUGAR HUNT

Materials:

100 8 oz. paper cups to represent animals (prey). Each is marked on the bottom as follows:

50 cups marked S (squirrel = 1 kg)
25 cups marked R (rabbit = 2 kg)
15 cups marked P (porcupine = 7.5 kg)
9 cups marked B (beaver = 20 kg)
1 cup marked D (deer = 75 kg)

Procedure:

1. Select a certain surface on which to spread the paper cups. This could be a counter, large table or the floor in one corner of a room or outdoors in the school yard. Set the cups out upside down so the students can see the letters marked. Using the chart above, write the names of the types of prey and the number of kilograms of food provided by each on the chalkboard.
2. Indicate the area where you have set out the cups. "This is the habitat of a population of cougars, or mountain lions. Each of you represents one cougar. Right now you will each try to find enough food in this habitat to survive for about a month, which is about 50 kg."
3. Select one student from the class and explain, "This cougar has been injured by tackling a big buck and now has a broken leg so that he or she will have to hunt on one leg." Tell the student to hop.
4. Select another student. "This cougar is blind due to an injury caused by a porcupine." (You can make a blindfold with some black paper and string.)
5. Select a third student. "This cougar is a female with two cubs and each cub needs 25 kg of food to live, so if they are all going to survive, she needs to find 100 kg of food."
6. Indicate the chart on the board and read it aloud to be sure the students understand what they're looking for. Ask each student to set up their cougar den by selecting a small area where they will bring their prey. This could be their desks or areas along the wall.
7. Give students the following instructions: "Each cougar must walk into the habitat to hunt. (Cougars don't run down prey, they stalk it.)

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COUGAR HUNT

When a cougar finds a prey animal, he or she picks it up and carries it to his or her den. Each cougar can only carry one prey animal at a time. Remember that in the wild, cougars don't fight over prey, as a resulting injury may kill them." The den can be represented by each student's desk, or a piece of paper placed at the edge of the habitat. The students continue to repeat the process until the game is over, picking up just one prey species per trip.

8. When all the paper cups have been gathered, the game is over, and each student returns to his or her desk to calculate the quantity of food he or she gathered.

Discussion Questions:

1. How many kilograms did each cougar gather? How many cougars can survive in the habitat? If more cougars played the game, would the habitat support them? Why not?
2. How many kilograms did the blind cougar gather? The injured cougar? The mother cougar? What are the chances of her cubs surviving in this habitat? Can a blind or injured cougar survive in the wild? Who is the mother going to feed first? (Explain that she will probably feed herself first to keep healthy so that she can tend to her cubs. If she stays healthy, perhaps the habitat will support healthy cubs in the future.)
3. What would happen to the cougar population if all the rabbits died of a disease?
4. What would happen to the cougar population if the water became polluted? Why would the concentration of the pollutant be greatest in the cougars?
5. Though this game is about the carrying capacity of cougars in a region, do the same rules apply to humans? How are they similar and dissimilar?

"Cougar Hunt" was adapted by permission from Joan Wagner, 9 Valdepenas Lane, Clifton Park, NY 12065. It is loosely based on "Oh Deer!" an activity developed by Project WILD, ©1983.

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EARTH: THE APPLE OF OUR EYE

Concept: Farmland is an essentially nonrenewable resource which we depend upon for our food.

Objective: A visual demonstration illustrates the limits on farmland, making the importance of conservation clear.

Grade Level: Upper elementary

Subjects: Math, science, social studies

Skills: Dividing, observing, deducting, problem solving

Introduction: Over time, better farming has made it possible to feed many of the world's people. But, with a limited amount of land and a growing number of people to feed from that land, each person's part becomes smaller and smaller. Protecting our land resources is therefore very important.

ACTIVITY 15

EARTH: THE APPLE OF OUR EYE

Materials:

1 apple for a teacher demonstration or enough apples for the class if students slice their own
1 knife for a teacher demonstration or enough knives for the class if students slice their own apples
1 napkin for a teacher demonstration or enough napkins for the class if students slice their own apples

Note: Some teachers prefer to make this activity truly "hands-on" by having each student cut his or her apple according the teacher's instructions. If you feel comfortable with students using knives in the classroom, you may want to consider this option. Otherwise, you can demonstrate the apple cutting at the front of the class.

Procedure:

As you go through this brief demonstration, ask the students the questions which are in quotation marks before revealing the answers noted in italics.

1. Show the apple to the class. "For this exercise, this apple represents our planet."
2. Slice the apple into quarters.
3. Hold out three of the quarters. "What does this part of the apple represent?" *They represent the oceans of the world.*
4. "What fraction is left?" $^1/_4$
5. Slice this section in half. Hold up one of the pieces.

   "This portion represents the areas where people can't live: the polar areas, deserts, swamps, very high or rocky mountains."

   Set this piece aside.
6. Hold up the other piece. "What fraction of the whole apple is this?" $^1/_8$

   "This piece represents the land where people can live, but not all of the soil is good for growing food."
7. Slice the $^1/_8$ piece into four equal sections. Hold three of the sections in one hand and one section in the other. Hold out the single section. "What fraction of the apple is this?" $^1/_{32}$

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EARTH: THE APPLE OF OUR EYE

8. Hold out the three sections in your left hand. "These $^{3}/_{32}$ represent the areas too rocky, too wet, too cold, too steep, or with too poor soil to actually grow food. They also contain the cities, suburbs, highways, shopping centers, schools, parks, factories, parking lots and other places people live, work, or use in other ways, but can no longer grow food."
9. Carefully peel the $^{1}/_{32}$ slice of Earth. Hold this peel out so they can see it. "This tiny bit of peeling represents the surface, the very thin layer of the Earth's crust upon which people grow food. It is less than five feet deep. It takes 100 years for one inch of this topsoil to form."
10. For dramatic effect, you can eat the small piece of apple, saying, "If we don't take care of this land, it will be gone."

This activity originally appeared in KUITATK, a Native American Science Education Association Issue Publication.

Discussion Questions: (if applicable)

1. What things cause land erosion?

   One example is deforestation. Branches and leaves shelter the soil from the force of rain and wind. So when the trees are cut down, the soil is blown and washed away. Another example is overgrazing. When cattle eat grass, they pull it out of the ground by the roots, taking some soil with it. Each bite leaves a patch of ground uncovered, exposed to the wind and the rain. Also, these animals have sharp hooves that tear up the surface a little with each step.

2. What is overfarming?

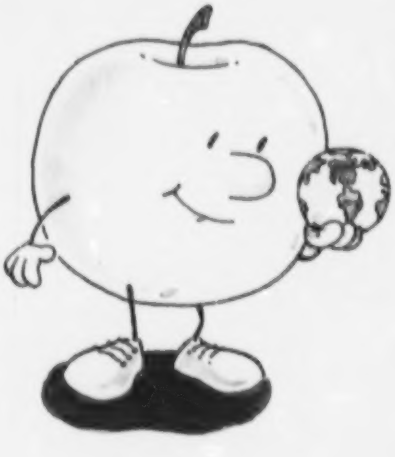
   Overfarming occurs when we ask too much of the land. We used to practice crop rotation, which means we divided farmland into sections, and grew a different crop in each section. Each year, the kind of crop grown in each section would be changed, and one section would be left unplanted, to let it rest for a year. Each kind of crop takes certain elements from the soil. If the same crop is grown in the same place for too many years in a row, the soil has no chance to renew itself. Eventually all of that particular element will be gone, and that soil will be unable to grow anything.

3. What are some ways we could help preserve farmland?

   By choosing not to build anything on land that could be used to grow food; by eating lower on the food chain; by working to reduce pollution, etc.

4. Where else does food come from beside farmland?

   Oceans. Remind students, though, that overpopulation also leads to overfishing and the dumping of pollutants into the waterways.



THE STORK AND THE GRIM REAPER

Concept: Population growth occurs when a species' birth rate exceeds its death rate. Worldwide, the human birth rate is currently three times the death rate. Every environment has a limit to the number of members of a certain species it can support. Humanity's rapid population growth has the potential to exceed the carrying capacity of this planet.

Objective: To illustrate the relationships between (1) birth rate and death rate, and (2) population growth within a finite space.

Grade Level: Lower and upper elementary

Subjects: Math, science, social studies

Skills: Observing, using deductive reasoning, researching

Introduction: Usually we think of carrying capacity in terms of how many frogs can live in a pond or how many cattle can be raised in a particular pasture. But carrying capacity applies to human beings, too. We consider more than just the basics of food, water and shelter when we measure an area's carrying capacity. We include the idea of *quality of life*. Because we expect so much more from our surroundings than animals do, we have to be more thoughtful about how many of us can live in one place. How many people can share a city, state or planet and still have that area provide each person with clean surroundings, a quiet place to think, a safe neighborhood, good schools, hospitals and so on? Humans don't want only to survive; we want to be happy and healthy, too.

ACTIVITY 16

THE STORK AND THE GRIM REAPER

Materials:

Clear container (plastic box or aquarium with at least a one-quart capacity)
An old towel
2 sheets of paper labeled "Stork" and "Grim Reaper"
Masking tape to attach labels to wearers
Bucket of water
Food coloring
1/3 cup measure and 1 cup measure.
World map or globe

Procedure:

Note: The information in quotations indicates what you should tell the students as you go through this demonstration.

1. Fill the bucket with water.
2. Add food coloring to make the water more visible inside the clear container.
3. Place the clear container with the towel under it in front of the class.
4. Ask for two volunteers from the class or pick two students to assist. Designate one the "Stork" and the other the "Grim Reaper." Each student should tape the appropriate label to him or herself.
5. Hold up the clear container.

   "This will represent the world, and the colored water in the bucket represents people."
6. "Stork, you'll be adding people to the world by pouring dippers of water into the container. Grim Reaper, you'll be taking people from the world by scooping water out of the clear container and pouring it back into the bucket."
7. "At this time, the world's birth rate is three times the death rate. Based on that fact, who should receive the large dipper? (Stork) Who should use the small dipper? (Grim Reaper)"
8. When correctly answered, signal the Stork and Grim Reaper to start. Make sure that for every dipper-full the Stork adds, the Grim Reaper subtracts one. They should continue in turn while the class observes.

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THE STORK AND THE GRIM REAPER

9. When it becomes clear that the water level is steadily rising tell the Stork and Reaper to stop.

Discussion Questions:

1. Why did the water level rise steadily?

   Because more was being added than taken out.

2. What would this mean if the clear container really was the world?

   It would mean that the Earth's carrying capacity has been exceeded and that not all of these people could survive.

3. What size would the Grim Reaper's dipper have to be for the water level to stay the same?

   The same size as the Stork's dipper.

4. Throughout history, the Stork and Grim Reaper's real-life dippers were usually about the same size. But over the past 200 years, the Stork's dipper has grown much larger than the Grim Reaper's. Can you think of some reasons why the death rate has gone down in recent years?

   Advances in medicine: *Doctors gradually became better at healing people because of new discoveries in the sciences and from increased contact with other countries, which allowed them to learn from each other.*

   Better sanitation: *People invented safer ways of disposing of garbage and human waste so their surroundings were cleaner and didn't breed so much disease.*

   Better nutrition: *Advances in farming made it possible to grow better food in greater quantities. Also, improvements in medicine made people more aware of the importance of eating a variety of foods.*

   All of these things worked to allow more people to survive infancy and childhood and extended the average lifespan. People used to live to be only about 50 or maybe 60, whereas now many people survive much longer. The average person in the U.S. lives to be 76 years old.

5. What is the carrying capacity of our classroom? Consider the following questions:

   How large is the room?
   How much space does each person take?
   How much space is taken by resources: tables, chairs, desks, etc.?
   How much open space is needed to have the class run smoothly?
   Could you comfortably fit twice as many people in the classroom as you have now?

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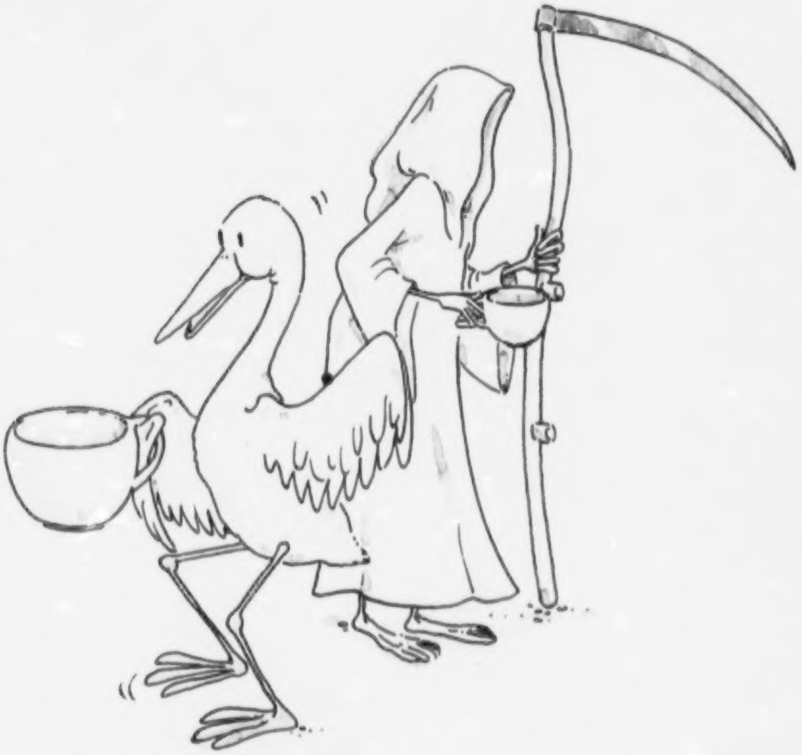
6. What is the carrying capacity of your home? (Consider the number of people who could regularly eat and sleep there.)

Follow-up Activities:

1. Show the different growth rates of the countries below.

United States:	Stork = 1 cup	Grim Reaper = 1/2 cup
Mexico:	Stork = 1 cup	Grim Reaper = 1/4 cup
Botswana:	Stork = 1 cup	Grim Reaper = 1/4 cup
Italy:	Stork = 1 cup	Grim Reaper = 1 cup
Japan:	Stork = 1 cup	Grim Reaper = 2/3 cup
Taiwan:	Stork = 1 cup	Grim Reaper = 1/3 cup

Point out where each country is on the globe or map before beginning. Be sure both sets of people work at the same speed, with the different growth rates shown by variations in sizes of dippers. The more slowly growing countries, of course, will have a more slowly rising water level. (Be sure that Italy's clear container starts out about half-full, so students won't be confused and think that it's completely unpopulated. The rest of the buckets can start out empty.)



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ACTIVITY 17

ZPG ISLAND

Materials:

"ZPG Island Scorecards" (1 per student)
1 deck of playing cards for each group of four students

Procedure:

1. Write the terms below on the chalkboard, but don't fill in the definitions until the discussion has started and you've given the students the chance to tell you what they know about these words. You can base the discussion on the sample narrative below.

   Population: the number of people living within a certain area

   Immigration: moving into one area from another area

   Emigration: moving out of an area into another area

   Zero population growth (or z.p.g.): births + immigration = deaths + emigration

   "Who can tell me what a **population** is?" (Fill in definition.)

   "Populations grow when people are born or move into an area. What do we call it when people move into one area from another?" (Fill in definition of **immigration**.)

   "Populations shrink when people die or move out of an area. The word we use to describe people moving from an area is similar to 'immigration.' Does anyone know what it is?" (Fill in definition of **emigration**.)

   "Populations stay the same size when births plus immigration are equal to deaths plus emigration. We say that a population that's stable is at zero growth." (Fill in definition for **z.p.g.**) "Zero population growth has been reached or nearly reached in several countries such as Austria, Belgium, Spain, Germany, Italy and England."
2. Divide the playing cards into red and black cards.
3. Divide the class into groups of four students.
4. Read or paraphrase the following statement for the class:

   "Each group lives on a small island with limited resources. If the population gets bigger than 21 people, some people will lack food and may starve. But if the population gets much smaller than 21, there won't be enough workers to harvest the food and to build homes to protect everyone from storms.

Concept: So that a population does not exceed the land's carrying capacity, it is important for it to reach zero population growth.

Objective: By playing a card game, students will be able to define the term **z.p.g.** or **zero population growth.** They will also understand some of the challenges involved in providing the necessary goods and services to a population whose size is fluctuating and whose resources are limited.

Grade Level: Upper elementary

Subjects: Social studies, science, math

Skills: Using logic, role playing, understanding of principles such as cause and effect and supply and demand

Introduction: Birth, death, immigration and emigration (out-migration) are the factors that shape the size of a population. It is best when a population is big enough to do all the work needed to sustain itself, and small enough not to exhaust the resources on which it depends. Achieving and maintaining such a balance involves a variety of challenges.

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ZPG ISLAND

Each group will receive a deck of cards, and each person in the group receives a scorecard to keep score. The object is to keep the population at 21 people or as close to it as possible. The player within each group who scores the closest to 21 by the end of the game will be the winner from that group. Here are the rules:"

- Face cards have a value of 10.
- Aces may be counted 11 or one.
- Number cards are equal to the stated number.

Red cards represent population growth: hearts equal births, diamonds equal immigration. Black cards represent population loss: spades equal deaths and clubs equal emigration. Red and black cards are kept separate throughout all games.

- Players may decline to draw at any point and choose to stop playing.
- Players draw from both the red cards and the black cards on every turn taken.
- Each player starts with a score (population) of 10 persons.
- Each player draws from the red cards first, adds up the score, then draws from the black cards and subtracts from the score.
- Players are "out" when they have scored more than 21, when they reach zero or a negative number, or when they have taken 10 turns.
- Those who make it to 10 draws add up the totals from each draw to get their Grand Total. The player with the total closest to 21 wins.

Discussion Questions:

Imagine that you and the other 20 people on your island have been able to harvest enough food for the winter. You have just finished building shelters and the bad weather is near. A boat lands on your island with 10 starving people who have left their island because of a terrible disease on it. They want to stay with you and seem desperate. The people of your island hold a meeting to decide what to do. Would you vote to:

a. force them off the island?
b. let them rest on your island for a day or two, give them some food and then send them away?
c. let them stay as long as they wish?
d. other?

What are your reasons? What if the people became ill? Would you keep them on your island and care for them or send them away?

Follow-up Activity:

Read aloud the story *From Island to Island* by Lynne Cherry in the next chapter. Have the students answer the discussion questions following the story.

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ZPG ISLAND

ZPG ISLAND SCORECARD STUDENT WORKSHEET

NAME____DATE________________

Draw	Add (+) Born or Immigrating	Subtract (-) Died or Emigrating	= Total
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
		GRAND TOTAL _____	

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COUNTING ON PEOPLE

MEETING PEOPLE'S BASIC NEEDS

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WHAT ARE PEOPLE'S BASIC NEEDS?

Now that students understand the dynamics of population growth, they can examine the impacts of population growth on the world around them. In this chapter, they will learn that people have basic needs: food, water, shelter and fuel. People also have basic human rights, such as receiving an education, being treated fairly by others and living in a safe place free of fear. As part of the human family, students should recognize that not all people have their basic needs met or enjoy basic human rights. Still, this is a goal that we, as global citizens, need to work toward.

Before beginning these activities, go over the following information with your students:

> In order to live, people need food, water, shelter and fuel. Many of us take these things for granted. But in many parts of the world and even here in this country (perhaps in our community), there are people who do not have enough to eat, have no home, or lack running water or fuel to heat their homes and cook their food.
>
> Often people must leave their homeland, the place they spent their childhood, because the land can no longer meet their needs. If the population has grown too large or too quickly, there may not be enough food to eat, trees to build homes and burn for fuel, or fresh water to drink for everyone in the area. Sometimes people move to another place because they can't find jobs or express their ideas freely. And sometimes people leave their homes to escape war and crime. Many people around the globe lack basic human rights such as the right to receive an education, be treated fairly by others and live in a safe place.
>
> There are many things that each of us can do to help people whose basic needs are not being met. We can help to share our resources when we have more than enough and volunteer our time to help others.

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ON HELPING OTHERS IN NEED

"Merry Christmas, little daughters! I'm glad you began at once, and hope you will keep on. But I want to say one word before we sit down. Not far away from here lies a poor woman with a little newborn baby. Six children are huddled into one bed to keep from freezing, for they have no fire. There is nothing to eat over there, and the oldest boy came to tell me they were suffering hunger and cold. My girls, will you give them your breakfast as a Christmas present?"

They were all unusually hungry, having waited nearly an hour, and for a minute no one spoke — only a minute, for Jo exclaimed impetuously, "I'm so glad you came before we began!"

"May I go and help carry the things to the poor little children?" asked Beth eagerly.

"*I* shall take the cream and the muffins," added Amy, heroically giving up the articles she most liked.

Meg was already covering the buckwheats, and piling the bread in one big plate.

"I thought you'd do it," said Mrs. March, smiling as if satisfied. "You shall all go and help me, and when we come back we will have bread and milk for breakfast, and make it up at dinnertime."

...That was a very happy breakfast though they didn't get any of it; and when they went away, leaving comfort behind, I think there were not in all the city four merrier people than the hungry little girls who gave away their breakfasts and contented themselves with bread and milk on Christmas morning.

—From *Little Women* by Louisa May Alcott

"I've been thinking," said Pooh, "and what I've been thinking is this. I've been thinking about Eeyore."

"What about Eeyore?"

"Well, poor Eeyore has nowhere to live."

"Nor he has," said Piglet.

"*You* have a house, Piglet, and I have a house, and they are very good houses. And Christopher Robin has a house, and Owl and Kanga and Rabbit have houses, and even Rabbit's friends and relations have houses or somethings, but poor Eeyore has nothing. So what I've been thinking is: Let's build him a house."

"That," said Piglet, "is a Grand Idea. Where shall we build it?"

"We will build it here," said Pooh, "just by this wood, out of the wind, because this is where I thought of it. And we will call this Pooh Corner. And we will build an Eeyore House with sticks at Pooh Corner for Eeyore."

—From *The House at Pooh Corner* by A.A. Milne

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WHEN THE CHIPS ARE DOWN

Concept: All resources on the Earth are limited and populations must compete for and share them.

Objective: Through a visual activity, students will gain an understanding of how resources are inequitably distributed throughout the world and why trade occurs.

Grade Level: Upper elementary

Subjects: Social studies, math, science

Skills: Using basic abstract thought, role playing, understanding of principles such as cause and effect, and supply and demand

Introduction: All resources on the Earth are limited and people must compete for and share them. The more people there are, the smaller each person's share of resources. The most basic resources humans and other animals need are food, water, and shelter. This activity will demonstrate characteristics of resource-rich and resource-poor countries; it will also demonstrate how and why competition and trade for these resources occur.

ACTIVITY 18

WHEN THE CHIPS ARE DOWN

Materials:

A set of poker chips (use exactly twice as many chips as the number of students who are participating. If possible, try to supply red, white and blue chips in equal proportions.)

Yardstick or tape measure.

Masking tape, yarn or string to mark off borders

Procedure:

1. Give students the following introduction:

   "In this activity, each one of you will pretend to be a country. Now, every country needs basic resources to support its people. What are some examples of resources countries need?" (Select a student to come up to the chalkboard and list the resources named by the class, such as food, water, energy, wood, and metals.)

   "Can anyone tell me what an import is? An export?" (Write the definitions on the chalkboard near the examples of resources.) "An import is a product we buy from another country because we can't or don't make the same thing here. An export is a product we sell to other countries who can't or don't make the same thing there. For this activity, these chips are going to represent different resources."

2. Select an indoor or outdoor area large enough to allow all students to move about physically. Mark off an area approximately 12′ x 12′ (about 3.6 m x 3.6 m)

3. Throw the chips into the square area and allow them to land randomly. All chips should be inside the square. If some fall outside, toss them back in.

4. Tell the students that upon a given signal each country should try to collect up to, but no more than, three chips. Do not explain the significance of colors; students should just try to collect three chips at first.

5. Give a signal for students to collect chips inside the square and signal for an end to the activity as soon as all the chips are collected.

6. Separate the class into four groups as outlined below, and inform them of the meaning of their collections.

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WHEN THE CHIPS ARE DOWN

Red = food   White = shelter   Blue = water.

Group 1: Those students (countries) which have three chips. These represent countries with rich resource bases. Such countries will be able to export more resources than other countries.

Group 2: Those with two chips. Countries with more limited resource bases. Exports possible and need for imports probable.

Group 3: Those with one chip. Countries with a very limited resource base. Exports minimal; more reliance on imports.

Group 4: Those with no chips. Countries with virtually no resources to support a human population adequately. No export capability. Maximum imports necessary.If further separation or scoring is necessary or desirable, use the following criteria:

Most Ideal	3 chips of 3 separate colors
▲	3 chips of 2 colors
	3 chips of a single color
	2 chips of 2 separate colors
	2 chips of the same color
▼	1 chip
Least Ideal	No chips

6. While the students are still in their groups, ask students to complete the following statement: "Since I have (number of chips), I feel __________."

Discussion Questions:

1. How many "countries" received three chips? two? one? none? What would it be like to be in each country?

   How would Group 1's ability to export resources without having to import much affect their wealth and well-being?

   They would be able to maintain their wealth because they would be selling products to other countries without having to buy products from other countries.

   How would Group 4's dependence on the resources of other countries affect their wealth and well-being? How would they import the resources they need if they had none to trade?

   Without money coming in, Group 4 would not be able to buy products from other countries. They would remain poor and without basic necessities.

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WHEN THE CHIPS ARE DOWN

What if a supplier nation's population became much bigger? Would there be as much left over for that country to export? Where would the resource-poor country get its food, water, and shelter?

As the supplier nation's population grows, the demand for resources in that country would also grow and there would be less available to export.

2. Does your country's population have a large and well-balanced resource base (3 chips of 3 different colors)? If not, what could you do to improve your situation?

   You could try to trade with other countries if they have something you need and you have something they need.

3. What would be some advantages and disadvantages of having a stable population if you had a large and well-balanced resource base?

   With a stable population, you could plan for the future of your resource use so that not all the resources are quickly used up.

4. Based on the resources you have, would you like to see your country's population increase, decrease, or stay the same? Why?

Follow-up Activities:

You may wish to repeat the activity after the students have learned the significance of the numbers and the chip colors. Experiment with such techniques as bartering and exchanging. Or consider the option of creating more chips (more resources). What effects do these techniques have on the outcome of the activity? Can the students think of any real countries which might fall into the different subgroups described above?

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ACTIVITY 19

FAMILY ROOTS

Materials:

Globe or world map

Procedure:

1. Give homework assignment: "I want each of you to interview three adults you know about the different places they've lived. They could be parents or guardians, grandparents, aunts, uncles, relatives of friends, or neighbors. You should answer the following questions:" (Write these on the board.)
   a. What is his or her name?
   b. What is this person's relationship to you?
   c. Where was he or she born?
   d. Why did his or her family come to live there?
   e. Where does he or she live now?
   f. Where else has he or she lived?
   g. What were his or her reasons for moving to and from each place?
2. The next day, mark the locations of states and other nations in which the class' collective friends and relatives have lived, and lead a class discussion about why people migrate. (See discussion questions.)
3. If any of the students in the class have lived in other places (cities, states, or countries), you might ask them why their families moved and what they like best and worst about their old hometowns and their new ones.

Discussion Questions:

1. How do you think life in your town is different from life in the towns of your ancestors? How is it the same?
2. What are some things that make a move difficult?
3. What are some of the reasons that people move?
4. Can you think of anything that might make you want to move?
5. Can you think of anything that could make you have to move?

Concept: To meet basic human needs and to seek a better life, people migrate from one place to another.

Objective:

a. This activity personalizes immigration and encourages students to learn about diverse backgrounds and consider reasons why people migrate from one country to another.

b. The Follow-up Activity also asks students to explore the differences between how human needs are met among men versus among women in many countries.

Grade Level: Upper elementary

Subjects: Social studies

Skills: Using abstract thought, collecting and analyzing data, role playing, interviewing

Introduction: People move from place to place for all kinds of reasons, sometimes by choice, sometimes not. We don't usually leave our homes without a reason. Sometimes it's because our homes are destroyed by war or natural disasters. Sometimes we can't find work in our own country, state or town and have to look elsewhere. Sometimes members of our families have moved to other places and we want to be together. Whatever our reason for moving to a new place, it is almost never an easy process.

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FAMILY ROOTS

Follow-up Activity:

If possible, locate a recent immigrant who could discuss his or her move with the class and answer their questions. If you have a woman visit the class, you may want to have her discuss with students how her life in her native country was different from the lives of men there. Also ask her how this varies with her experience in this country.

In most parts of the world, the status of women is lower than that of men. Girls and women are often denied some of life's necessities and human rights afforded to men in their countries. For instance, women have fewer opportunities to receive an education, work outside of the home, own property, vote or hold political office in most countries.

In many cultures, couples prefer to have sons because they are expected to support them in their old age and continue the family farm or business. Girls are married off at a young age and leave their family homes. In Bangladesh, for example, the average age of marriage for a girl is just 12 years old! Because boys are preferred, girls often receive less food and health care than their brothers.

You may want to explain this gender discrimination to students this way. Divide the class in half. Tell one half that they can live their lives as they expect, finishing school and deciding what they want to do in life. Tell the other half of the class that they would have to end their schooling and spend their days doing chores. This is what they will continue to do as they grow up and have children, while the other half of the group has more choices. Discuss with the class how this makes them feel. After the discussion, explain that in some countries, such limitations really are put on people, and that it is based solely on gender. This may stimulate further discussion and may be a good lead into a research assignment.

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FROM ISLAND TO ISLAND

ACTIVITY 20

FROM ISLAND TO ISLAND

Materials:

The story, *From Island to Island*, (included in this activity); read to younger students or copy for older students

Materials for creating a backdrop for a play or puppet show such as large sheets of paper, paints and markers (optional)

Props for the play such as tropical fruits, straw hats, tropical music, and so on as described in the Follow-up Activity (optional)

Procedure:

1. For younger students, read the story, *From Island to Island*. For older students, copy the story for each one and have them read it on their own.
2. Discuss the story using the following questions as a guide.

Discussion Questions:

1. Why did the islanders leave Great Coral Island and then Emerald Island? Did they understand what had caused the destruction of these islands?
2. What were the basic needs of the islanders that could no longer be met as their populations continued to grow?
3. If you lived on an island, what are some of the things you would need to survive? What kinds of things would you need to do to make sure you always had enough to eat?
4. If you were one of the islanders arriving at an untouched, lush island, do you think you would foresee any problems ahead? Why or why not?
5. What did the islanders have to do to keep Hope Island a beautiful, healthy place to live?

Follow-up Activity:

Have students turn this story into a short play or puppet show. For the set design, divide the class into six groups. Each group will draw and color one of the following backdrops:

1. Great Coral Island before overpopulation
2. Great Coral Island after overpopulation
3. Emerald Island before overpopulation
4. Emerald Island after overpopulation

Concept: Every piece of land has a carrying capacity—a population that can be supported by the available natural resources without degrading the environment.

Objective: Students will read (or have the teacher read to them) the short story, *From Island to Island*. They will answer the discussion questions as a class and act out the story.

Grade Level: Lower and upper elementary

Subjects: Language arts, science, social studies, visual and theater arts

Skills: Reading, reading comprehension, drawing, role playing

Introduction: There is a limit to how many people can live in any one area, given the resources of the surrounding land and water. When too many people try to use the limited resources, each person must make do with a smaller share. When nonrenewable resources are used up, they will never return. This is a story about what happens to a group of people on a beautiful island as their population continues to grow.

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5. Hope Island

6. The open sea

Arrange chairs in the shape of a boat that transports the islanders to their new destinations.

Assign students the role of the grandparent, the grandchild and the great-grandchild. All of the other students will play the people of the island. As the grandparent tells the story, have the students move background pictures in and out and have more people enter the stage to represent the population growth on the island.

You may want to bring in props for the play such as tropical fruits (bananas, mangos, coconuts and pineapples), straw hats, a tape of calypso or Polynesian music or anything else which suggests life on a tropical island.

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FROM ISLAND TO ISLAND

BY LYNNE CHERRY

This is the story my grandmother told me once long ago when I was a child. We were on a boat sailing across the sea looking for a new home.

"When I was a little girl like you," she began, "I lived on Great Coral Island. Once our home had been a place of beauty. But all the islanders had many children, and little by little the people cut down the forests. Then the sun scorched the earth, the water dried up, and the crops withered and died.

So our family sailed off, looking for a new place to live. We sailed for many days, and I was afraid that we would never find land. But at last an island appeared on the horizon. It sat like a jewel in the vast green sea, shimmering a deep, dark emerald green.

We landed on the island and found clear streams that provided water and rivers teeming with fish. We named it Emerald Island.

Our families grew as the years went by, until a hundred people lived on Emerald Island. Each person drank the island's water, ate the island's fruit, and cut down the island's trees for houses and firewood.

I grew up and married and myself had ten children. By then most of the trees were gone, and the island was baked by the sun. Emerald Island was no longer green. The crops withered and turned brown. There was no longer enough for everybody. I did not have food to feed my children. I lost five of them and my husband to hunger.

Emerald Island had become too crowded. By the time you were born, there were hundreds of people living there—on a barren island. There has never been enough for you to eat. You children know hunger all too well. And that is why thirty of us have decided to leave Emerald Island and look for a new place to live."

That was the end of my grandmother's story.

We had lost sight of Emerald Island within a few hours. For days we sailed. Like my grandmother so many years before, I was afraid that we would not find another island. Nobody knew where we were going. We just followed the winds. Finally we saw land.

We arrived at a large island and stared in wonder at the beauty of the green forest. Fish filled the streams of cool water that rushed through the forest. The trees were heavy with fruit. We called it Hope Island.

The next few years on Hope Island were indeed full of hope and happiness. For the first time in my life I always had enough to eat!

I grew up and married a fine young man. We had a daughter. Other people had children, too. There were now eighty people on the island. Many of the trees had been cut, so there was not as much fruit. The streams did not rush through the forest as fast, and they were not full of fish. Still, we were full of hope.

But one evening, my grandmother asked everyone to gather together. She told us that she probably did not have much time left to live and there was something she wanted to say before she died.

My daughter sat at her feet as I had done so many years before, when I was a little girl. My grandmother told of how, as a child, she and her parents had sailed away from the parched Great Coral Island. She told of finding Emerald Island, so lush and green, with food and water for all, and of her sadness upon leaving it, crowded, brown, parched and dry.

Continued on next page

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FROM ISLAND TO ISLAND

Continued from previous page

"We ruined Emerald Island," she said. "We made it a desert, and now we are doing the same thing to Hope Island. *There are too many of us*. Fewer people would eat less fruit and fish. There would be enough for all—for us, our children, and our children's children.

When my grandmother finished, there was silence. Then my daughter spoke: "Mother and Father, we're so happy—just the three of us. Could our family stay the same?"

I looked at her and at my grandmother. "Yes," I answered. "Our family is just the right size for a family on Hope Island."

That night my grandmother died, but her words stayed with us. We have been on Hope Island for 50 years. Now I am the wise old woman of the island. Each year I tell my grandmother's story of sailing from island to island. We 70 Hope Islanders are happy and well fed. Our island shimmers a deep, dark green, like a jewel in the vast green sea. There is a bright future for our children and our children's children on Hope Island.

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ACTIVITY 21

HELPING HANDS

Materials:

Current local phone book
A copy of the book *Stone Soup* as told and illustrated by Marcia Brown. New York: Charles Scribner's Sons, MacMillan Publishing Co, ©1947. *Stone Soup* is available in libraries and bookstores.
Student Worksheet (1 per student)

Procedure:

Look through the "Social Service Organizations" section of the yellow pages in the phone book. Call a few facilities that are likely to need canned food, used clothing and/or toys. Interview a staff member. Ask about their mission, who they serve, what services they provide, where they get their funding and so forth. (Possibilities include shelters for homeless people or battered women, food banks and soup kitchens.)

YOUNGER ELEMENTARY

1. Select a facility from your research. Draft a letter to the parents/guardians of your students. In it, describe the facility and the class project and include a list of the things the facility needs. Also, specify a date on which the supplies will be donated to the organization. (Two to four weeks from the first day should be sufficient.) Make a photocopy of it for each student to take home.
2. Read the book *Stone Soup* aloud to the class.
3. Lead a short discussion about the story. Highlight the fact that the small contribution made by each person added up to a big success for the group.
4. Explain that people in your area need help like the men in the story did, and that the class is going to work together to provide it.
5. Give a copy of the letter to each student. Explain what it says and that they are to show it to their parents/guardians so they can work on the project together.
6. Explain that the more people involved in helping, the better. Instruct them to make posters about the food/clothing/toy drive they are sponsoring (this can be done individually or in groups). The class should then hang the posters in highly visible places around the school. One of the students could make an announcement about the drive over the P.A. system or in a school assembly.

Concept: There are people in most communities in this country who need some form of assistance.

Objective: Students organize a school-wide event to help others in the community through local social service organizations.

Grade Level: Lower and upper elementary

Subjects: Social studies, home economics

Skills: Organizing, events planning, role playing, using abstract thought

Introduction: Although we are one of the richest countries in the world, some of our citizens' most basic needs are not being met. People need help for all kinds of reasons. Sometimes people lose their jobs and it takes them a while to find new ones. When people first arrive here from another country and don't know the language, it's much harder to get an education or a job. Some even have to leave their own homes because they are unsafe. At these times, people may need clothing, food, and a place to stay while they get the training or other help needed to be independent again.

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HELPING HANDS

8. On the last day, count up all of the donated items in each category and announce the totals to the class, and perhaps have a small party to celebrate the accomplishment. Again, stress how the small contribution made by each person added up to a substantial achievement by the group. The totals should be announced to the entire school at the next opportunity.
9. Another alternative to having the students bring in canned goods is to have them prepare something themselves, such as peanut butter and jelly sandwiches to deliver to a local shelter or soup kitchen. These would need to be prepared the day of delivery.
10. As a class, write a letter to the facility's staff (to go along with the donations), describing what they learned from the project.

Follow-up Activity:

Have the class present *Stone Soup* as a play, perhaps with a postscript about the class' experience helping others in the community.

UPPER ELEMENTARY

Use the instructions for the younger elementary version, but with the following changes:

1. Only use *Stone Soup* if it is appropriate for this age level.
2. Rather than choosing an organization yourself, present information about two or three facilities to the class and let them vote on which they would like to help.
3. Don't prepare letters to the parents; have the students take notes about the project and instruct them to present this information to their families themselves. This should include a list of all the items that are acceptable for donation. Make it clear that you are asking for things they and their families don't need anymore, but that are still functional. Dirty or broken items are not acceptable.
4. Part of the poster/flyer-making assignment should be distribution; finding good, visible, appropriate locations around the school to hang the posters, each student taking responsibility for making sure a certain member of the faculty gets a flyer, making the announcement over the P.A. system or in an assembly, etc.
5. During the celebration on the last day, be sure to discuss their impressions about the activity (use the following discussion questions).
6. One of the students should announce the totals to the school.

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HELPING HANDS

Discussion Questions:

1. How did you feel while you were working on this project? How did you feel at the end?
2. Do you think it's important for people to make a point of doing things like we did? Why or why not?
3. People need food and shelter to stay alive, but they need more and different things to be happy. What are some of those things?
4. Do you know of people who don't have those things? How could we work together to give those things to people without them?

Follow-up Activities:

1. Have students research an organization on their own and find out what services it offers and to whom, and what sorts of volunteer help it uses and needs. (See Student Worksheet.)
2. Have students interview their parents/guardians or another adult they know about his or her volunteer experiences. Why did they do it? Did they like it? How did they hear about it?

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HELPING HANDS

STUDENT WORKSHEET

NAME____ DATE __________________

Look up the "Social Service Organizations" section of the yellow pages in the phone book. Choose one you are interested in and fill in the sheet below, explaining what they do (what services they provide and to whom), and why you think it is important and/or interesting.

I am interested in ____

Their office is located at ____

The phone number is __________________ They help __________________________

____

by providing them with ____

____

I think this organization is important/interesting because __________________________

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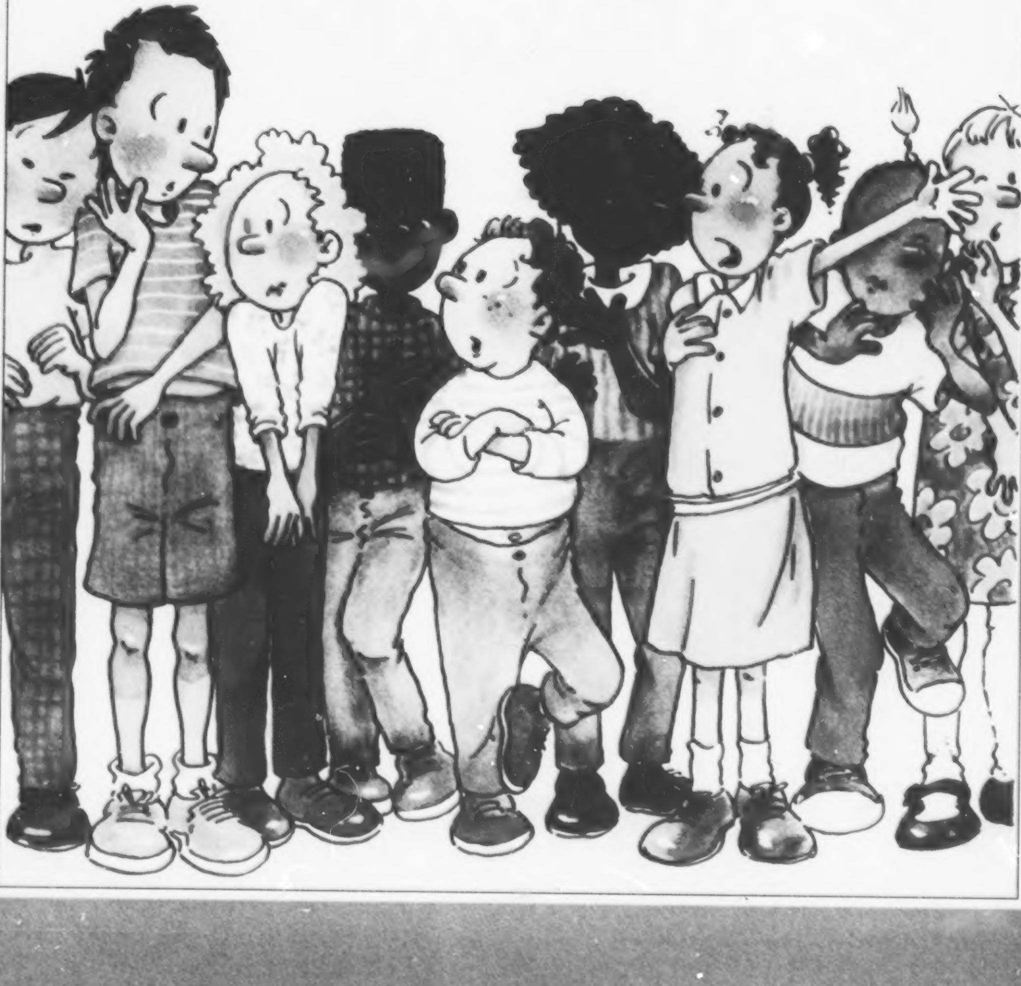
CROWDING



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WHY DO PEOPLE NEED SPACE?

In the last chapter, students learned about the basic needs that must be met for people to survive. It is also important for people to enjoy personal space in their homes, school and in public. The following activities are about crowding and population density. Sometimes the resources are available to support many people, but the quality of life suffers if people do not have some personal space.

Before beginning these activities, go over the following information with your students.

Do you have your own room at home or do you share it with a brother or sister? If you share a room, you know that it takes a lot of cooperation to live closely with someone else. You often have to compromise on what to hang on the wall, what time to go to bed, or maybe you argue over ownership of clothes or toys. Maybe you secretly hope for the day when you have your own room. As much as we enjoy spending time with friends and family, we all sometimes want some space to ourselves.

Some of us live in apartments in cities where we are surrounded by people and buildings. Some of us live in the country surrounded by lots of land. Each environment has good and bad points. Even if we live in cities, though, we know that it's important to sometimes go to a park or another place where there is more space and not as many people around us.

There are times when we might enjoy being in crowds, like at a baseball game or at a parade. Sometimes crowds make doing things more difficult. If there are crowds of people at a fair or amusement park, you may have to wait in long lines and not get to enjoy many rides. On the streets, many cars can cause traffic jams, making it harder to get from place to place. The more people there are, the more cooperation and compromise you need to do lots of daily activities.

Open space is important to all plants, animals and people. Plants need room for their roots to expand, animals prefer roaming in the wild to being confined in cages, and people thrive better, too, if they have green space nearby and some room of their own.

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Crowds

Crowds pushing
Into the subway
Scare me.
(Maybe I'll grow out of it.)
Crowds rushing
At the traffic light
Make me wonder.
Crowds
Passing
Dashing
Across the honking streets
Carry me along.
Crowds that stand
In
Long
Lines
Forever
For a ticket.
For a movie.
I don't dig.
Crowds
Slicking
Up and down escalators.
Crowds
Popping out of elevators
Don't turn me on.
(Maybe I'll grow out of it.)

Virginia Schonborg, Subway Swinger, New York: William Morrow & Company, Inc. ©1970
Appears in the Random House Book of Poetry for Children

CROWDING CAN BE SEEDY

Concept: Crowding affects the ability of living things to thrive.

Objective: A simulation and gardening lab give students hands-on experience with the effects of increasing population density.

Grade Level: Lower elementary

Subjects: Science, social studies, math

Skills: Observing, collecting and analyzing data, basic gardening, understanding cause and effect

Introduction: Different plants and animals need different amounts of space to be healthy. In this activity, students will first simulate seeds sprouting together in a crowded pot and then plant real seeds in a gardening lab to determine how space makes a difference in their growth.

ACTIVITY 22

THE SPROUTS GAME

Materials:

Chalk, yarn or tape to show borders of a 5′ x 5′ (1.5 m x 1.5 m) area in the classroom

Procedure:

1. Mark off a 5′ x 5′ (1.5 m x 1.5 m) area.
2. Ask someone to assume the role of a seed. The seed is "planted" inside the square and remains dormant. (Person should be sitting with head tucked.) Given a signal to sprout, the seed slowly becomes active and finally becomes a mature plant, standing and slowly waving its stem and branches (using arms and upper body).
3. Now plant more and more seeds (students) in the same area and (try to) repeat the growth process each time.

Discussion Questions:

1. What happened to some of the seeds?
2. How did you feel if you did not have enough room to sprout and grow?
3. Think of your own home and the people you share it with. What would it be like if there were two or three times as many of you living there? What things might there be too much or not enough of? (Beds? Food? Hot water in the morning? Space? Privacy? Quiet? etc.) How do you think you and the people you live with would like that?

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CROWDING CAN BE SEEDY

ACTIVITY 23

GARDEN GROWTH

Materials:

Package of radish seeds (or other fast-germinating seeds)
Potting soil (or other planting medium) and sunlight
Scissors
Half-pint milk cartons (one per student)
Water-catch basins (plastic lids, aluminum pans, etc.)
Labels

Procedure:

1. Make planting pots by cutting off the tops from milk cartons and using the bottoms.
2. Punch a few holes in the bottoms of the cartons for drainage.
3. Fill the pots with potting soil to about 1/4" below the rim.
4. Distribute the seeds as follows: Give 1/3 of the class (Group 1) one seed each; give 1/3 of the class (Group 2) two seeds each; give 1/3 of the class (Group 3) six to ten seeds each.
5. Plant seeds at the depth recommended on the seed package. Each student should plant all his or her seeds in a single hole in the middle of the carton. Students should label their cartons with their names, the number of seeds planted, and the date.
6. Set the pots in a lighted spot and keep them moist. Seeds should germinate in about one week. Maintain the plants during the growth period and make notes on growth observed in each group.
7. Harvest the radishes when foliage appears thick and mature. Compare size.

Discussion Questions:

1. Which student grew the largest radish? The smallest?
2. Which group overall grew the largest, most healthy-looking radishes? Why?

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POPUMONSTERS

ACTIVITY 24

POPUMONSTERS

Concept: The larger the group, the more difficult it is to act cooperatively as a group.

Objective: These two physical games illustrate the clumsy and often inefficient operations of larger populations. The games are mostly noncompetitive.

Grade Level: Lower elementary

Subjects: Math, social studies, physical education

Skills: Cooperating, problem solving as part of a group

Introduction: When there are many people trying to complete an activity, such as shopping at the grocery store or driving to and from work, it can create problems. The more people there are, the more cooperation is required for getting things done. In the following two physical games, students work in groups to complete tasks. They will recognize some of the inefficiencies of trying to work in such large groups, and they will also use problem-solving skills to find cooperative strategies.

Materials:

Watch with a second hand
Measuring tape (optional)
Whistle
If possible, find a live or preserved millipede specimen or ask students to collect one or two to show the class.

PART 1: MILLIPEDE STAMPEDE

The challenge of this part of the activity is to copy the movement of the millipede for a certain amount of time. This will take both cooperation and coordination from every student.

A millipede is an arthropod with two pairs of legs for every one of its many body segments. Millipedes are more commonly called "thousand leggers" although most species have about 100 legs. The movement of all those legs is well-coordinated. We're going to try to do that together to find out how easy or difficult it is to be that coordinated.

Procedure:

1. Direct the students to form a line. (The longer the line, the more fun and challenging the activity.) Each person in line should closely hug the person in front of him or her. Each one becomes part of the millipede.
2. At your signal, the "millipede" should begin to walk as instructed by the first person in the line. The segments should remain close together. If any segment separates, the rhythm will be broken. One to three minutes of the activity should be enough to demonstrate the "millipede's" ability to work together.

PART 2: POLYPODAPEDE

This is another exercise in which participants must cooperate in order to carry out the challenge successfully. It may also point out how inefficient multi-person systems can be. The challenge is to create four-body "monsters" that can move a given distance without breaking apart.

Procedure:

1. Designate teams of four students.
2. Inform the teams that they will become monsters. These are four-body monsters, physically arranged so that all four bodies must function as one unit.

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POPUMONSTERS

However, this one unit may only have three points of contact with the ground—hands or feet. The points of contact also must not be alternated or interchanged but must remain the same while the monster is moving.

3. Allow a five-minute "huddle" for each team to test physical configurations.
4. At the end of the huddle period, test each monster's ability to move a predetermined distance successfully. Tests may be run in simultaneous "heats" or all together. Remember, the monsters need not race against each other. However, you may wish to time each one as it attempts to complete the course.

Discussion Questions:

1. How does walking millipede- or polypodapede-style compare with walking by yourself? How would you like to walk to school or to the store everyday in one of these styles?
2. When you are in some of the following situations, is it better to be one of a few people or one of many? Why?
   a. At the grocery store
   b. At the doctor's office
   c. Standing in the lunch line
   d. In the car
   e. At a swimming pool
   f. On a sports team
   g. On the bus
   h. Playing tug-of-war

OPEN SPACES

Concept: In order for students to see the danger of overdevelopment, they must understand the importance of open spaces.

Objective: Students estimate and verify the amount of outdoor space necessary to meet the oxygen needs of the entire class.

Grade Level: Upper elementary

Subjects: Social Studies, science, math

Skills: Collection and analysis of data

Introduction: The more people there are, the less open space we have. For example, if our population doubles, we will need more houses, schools, hospitals, libraries, grocery stores, roads, parking lots, and so on. All of this construction decreases our open space. We need open space for many reasons, one of which is the production of oxygen.

ACTIVITY 25

OPEN SPACES

Materials:

Pen or pencil
Scrap paper
Calculator (optional)
String
Geranium leaves (optional)
Microscope or magnifying glass (optional)

Procedure:

1. Show students the stomata of geranium or other leaves, using a magnifier. Explain that "Plants make oxygen. It comes out of tiny openings like this one, called the 'stomata.' Almost all of the oxygen we breathe is made by plants."
2. Ask the class "How much grass do you think is needed to provide the oxygen needed by one person for one day?" After a few guesses tell them the answer, "A square of grass about 1.5 m x 1.5 m (or 5' x 5')."
3. Ask the class, "How large an area do you think is needed to make a day's worth of oxygen for the entire class?" Write down this number.
4. Cut a string 6 m long (20') for each student. Go outside and have each student lay out a 1.5 m x 1.5 m square of string (a 5' x 5' square). Make sure students' spaces are adjacent to each other, not overlapping, and record the number of square feet or meters with the class estimate.
5. Help students estimate how much open space is needed to supply all the students in the school with oxygen.
6. Discuss the importance of open spaces in communities.

Discussion Questions:

1. Where do people living in the city get their fresh air supply?
2. We need open space for air. Why else do we need open space?
3. As the population grows, more land is developed for homes, offices and roads. What are the possible consequences of living with more people and less open space?

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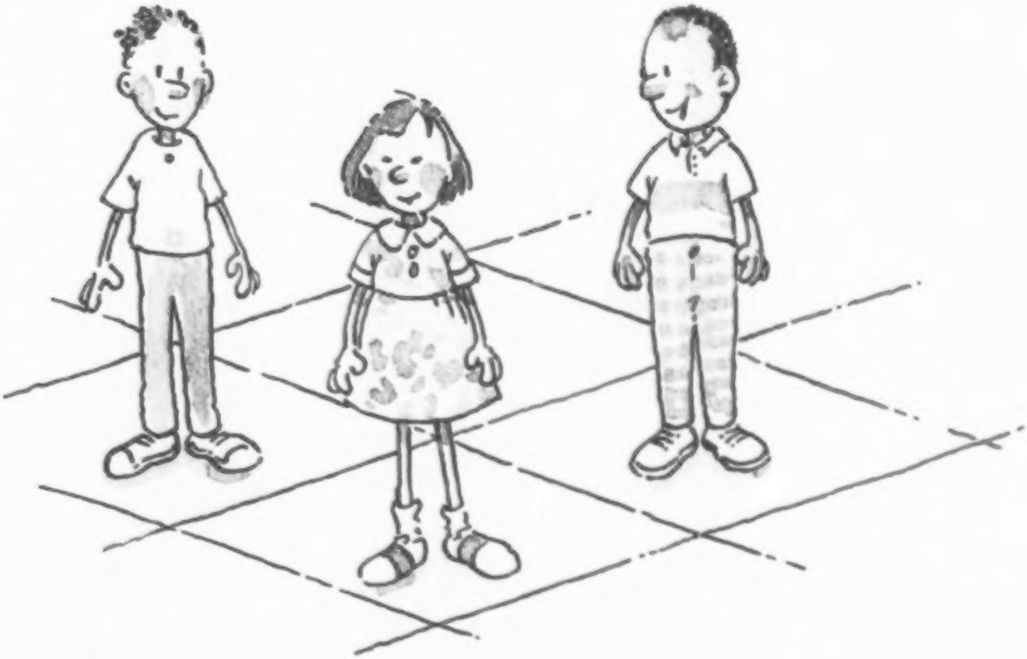
OPEN SPACES

Follow-up Activities:

1. Using maps of the community, have students estimate the total area of land devoted to public parks and open space. Discuss whether this amount is sufficient, insufficient, or more than sufficient for community needs.
2. Using population totals provided by a recent *World Almanac*, ask each student to calculate the amount of open space needed to provide oxygen for city, county, state and/or national needs.
3. Using maps of New York City and current population estimates for Manhattan, have students determine whether Central Park is adequate to meet the oxygen needs of all Manhattan residents. Central Park is 2.5 miles long and .5 miles wide.
4. Lead students in a tree-planting event to provide more oxygen producers for the school ground. This could be planned to coincide with an environmental holiday such as Arbor Day or Earth Day.



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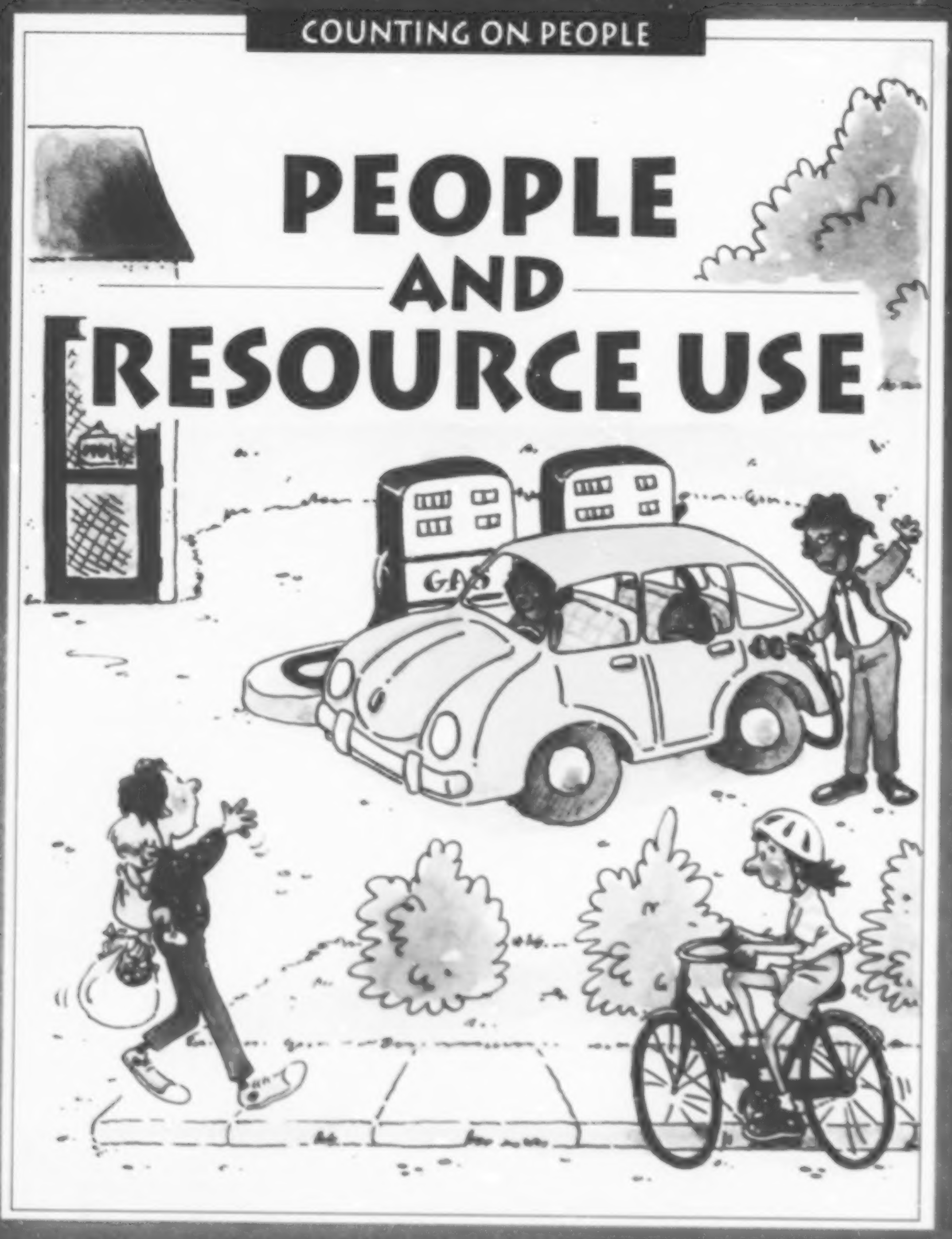

COUNTING ON PEOPLE

PEOPLE AND RESOURCE USE

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HOW DO PEOPLE USE THE EARTH'S RESOURCES?

In Chapter 4, students learned that people need certain resources to meet their basic needs for food, shelter, water and fuel. But if these resources are not used wisely, there will not be enough for present and future generations. In this chapter, students will learn about the unique relationship that people have with both renewable and nonrenewable resources, focusing specifically on water, trees, energy sources and minerals.

Before beginning these activities, go over the following information with your students.

> Everything we use to survive and to enjoy life comes from resources from the Earth. The food we eat comes from plants grown in the ground, from animals which live off the land, or from fish that live in the sea. Our homes are built from wood which comes from trees, or maybe with bricks which are made from clay and straw. Our clothes might be made from natural fibers grown on plants (cotton) or from the fleece of sheep (wool). Even man-made cloth, such as polyester, combines elements found in the Earth.
>
> Much of our fuel which heats and cools our homes, cooks our food, powers our cars, TVs, radios, computers and appliances comes from elements found in the ground, such as oil, coal and natural gas. Minerals and fuels from the ground are **nonrenewable resources** and can't grow back. Once we use them all up, they are gone forever.
>
> All of these natural resources are limited. There is a fixed amount of land on which to grow crops. If we use more of that land to build homes, schools, roads, shops and factories, there will be less land on which to farm.
>
> It is the same with trees. We depend on trees to clean the air, give beauty to the land and supply us with paper, wood, nuts and fruits. It takes trees a long time to grow, so if we cut down too many or use forest land for other things, we won't have enough trees for people to use and enjoy.
>
> There needs to be a balance between people and the resources we use. If there are too many of us, and if we use more resources than we need, we will upset the balance.

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It's Up to People

It's up to people to save all the trees
That still find a home in our woods.
Animals don't wield the power we do.
Though they'd certainly help if they could.

We'd see warthogs and pigs
To save fiddleleaf figs:
Baby chicks cheeping
To keep willows weeping:
Cats with a shine
For the loblolly pine:
Polars and pandas
To save jacarandas:
Even queen bees and princesses
For photosynthesis.

But it's up to people to save all the trees
That still find a home in our woods.
Animals don't wield the power we do.
Though they'd certainly help if they could.

By Sandy Stryker from Mother Nature Nursery Rhymes
Advocacy Press. Santa Barbara. California ©1990. Reprinted with permission

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ENERGY IMAGERY

Concept: Energy conservation is important in protecting the environment, sharing resources with others around the world, and making sure there are enough resources for future generations.

Objective: Through guided imagery, students will compare their energy use with that of a Native American in the past and a child from India in the present. They will then determine ways that they can conserve energy in their homes and schools.

Grade Level: Lower and upper elementary

Subjects: Social studies, science, home economics

Skills: Imagining, making comparisons, prioritizing, practicing conservation techniques

Introduction: The American way of life is very energy intensive. Although Americans make up only 5 percent (1/20) of the world's population, we use 25 percent (1/4) of the world's energy resources. In fact, one American uses as much energy as that of 3 Japanese, 6 Mexicans, 12 Chinese, 33 Indians or 422 Ethiopians. In many countries, people have enough energy for their daily needs, but use the energy more efficiently than Americans do. In other countries, people lack the energy resources they need to live comfortably. Using energy means burning fuel (oil, gas, coal, wood) which causes air and water pollution. There are many easy ways to conserve energy, so that we lessen our harmful impacts on the environment.

ACTIVITY 26

ENERGY IMAGERY

Materials:

"Energy Miser Activities Chart" (1 per student)

Procedure:

In this activity you will be asking students to use their imaginations while following simple instructions. The class will be led through three "guided imagery" experiences. In each case, the class is asked to consider a way of life and the way energy is used in that life.

1. Begin by asking the class if they have ever wondered what it would be like to have lived at some other time. Explain that you are going to take them on a guided journey back to a time when only Native Americans were found in North America. Give them the following instructions:

   "I want you to settle yourselves into your seats and then to let yourself relax. Close your eyes. Everything around you is becoming quiet and settled. Quiet your body and quiet your mind until you feel soothed and peaceful. Now I am turning the clock back and I want you to become a young Native American sleeping in a tepee on the North American plains. You are covered by a buffalo robe and as the first rays of sun enter the tepee you are aware of those around you stirring and rising. Now I want you to imagine that you are getting up and starting your day. What are the things that you are seeing and touching? Don't answer out loud; just think about it." (Pause a few seconds after each question.) "What will you do first? If you are eating something, what is it and how might it have been prepared? What sounds are you hearing? What things do you use as you get ready to start your day?"

   "Now I am turning the clock forward through the years and you are returning to today. Let's open our eyes and share some of the images you saw, the things that your body and hands felt, the smells and sounds of that morning long ago." List these things on the board.

2. Now ask the class to quiet and relax themselves again and take them on a journey halfway around the world to the country of India. It is the present time and the journey takes them to a small village:

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ENERGY IMAGERY

"Now I want you to travel to the country of India. It is the present time and you are waking up in an Indian village in a small hut with a dirt floor. The two-room hut houses you, your parents and your four brothers and sisters. There is no indoor plumbing or electricity in the hut. Because you are in a tropical climate, the day promises to be warm and humid. Now I want you to imagine that you are getting up and starting your day. What are the things that you are seeing and touching?" (Pause a few seconds after each question.) "What will you do first? If you are eating something, what is it and how might it have been prepared? What sounds are you hearing? What things do you use as you get ready to start your day?"

Have students hold these images in their heads. Ask them to open their eyes and list some of the answers to the questions you posed. Write these on the board.

3. Now ask the class to quiet and relax themselves for a third time and take them on a shorter journey back in time to this morning in their own homes when they were in bed and the alarm went off.

"I want you to remember getting out of bed and doing all the things you do to get ready for school. Retrace all of your steps and as you do, touch again all the things you used that use energy—all appliances, cars and buses, bath and shower. Try to remember and count them as you continue to get ready for school."

Now bring the class back to the present and make a list of the energy-using appliances and utilities. Ask the class to use a #1 to group all those items which they feel are required for survival. Use a #2 to group those which are not necessary for survival.

Discussion Questions:

1. Which energy-using appliances have we come to depend on to make our lives easier, save time and make us more comfortable? Are there any which are nice to have, but you could do without or use less often?
2. What aspects of your imagined life as a Native American years ago seemed better than your own lifestyle? Which aspects seemed worse? What aspects of your imagined life as a child in an Indian village seemed better than your own lifestyle? Which aspects seemed worse?

Follow-up Activity:

Duplicate the "Energy Miser Activities Chart," one for each student. Ask students to take the chart home and, over a period of time (a week, month, semester, etc.), record how many times they did the activities.

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ENERGY IMAGERY

STUDENT WORKSHEET

NAME____DATE____________

ENERGY MISER ACTIVITIES CHART

Activities	Checks or Initials
Turned lights off when leaving a room	
Rode bike or walked instead of being driven by car or bus	
Recycled cans, bottles and paper	
Used cold water instead of hot	
Reminded a grown-up to do one-stop shopping	
Went for a walk with family instead of a drive	
Reminded a grown-up to check home insulation	
Checked to see that the thermostat is set at 65 degrees in the winter and 74 degrees in the summer	
Persuaded a grown-up to have the car tuned twice a year	

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TIMBER!

ACTIVITY 27

TIMBER!

Materials:

For each group of four students you will need:
120 craft (popsicle) sticks in a coffee can with a rubber band around them
32 craft sticks in a rubber band
Stopwatch or clock with a second hand

Procedure:

1. Divide the class into groups of four students. For each group, assign the following roles: lumberjack, forest, forest manager, timer.
2. Give 120 craft sticks in a coffee can to each student representing the forest. These sticks represent the supply of trees available to the lumberjack for cutting.
3. Give 32 craft sticks to the students representing the forest managers. These sticks represent trees that will grow during the game.
4. The lumberjack records the transfer of trees each minute on a chart like the one illustrated.

Minutes	No. of trees at beginning of minute	No. of new trees	No. of trees cut	No. of trees trees at at end of minute
1	120	+4	-1	123
2				
3				
4				
5				
6				
7				
8				

5. Begin the game when the timer gives the signal. After 15 seconds, the timer tells the forest manager to give the forest one tree. Every 15 seconds for the rest of the game, the forest manager adds another tree to the forest. In doing so, the forest manager simulates the average rate at which trees grow to maturity and become timber reserves in the real world.

Concept: With continued population growth, renewable resources, such as trees, are often used faster than they can be replaced.

Objective: In this role playing simulation, students will observe what happens to a forest when the demand for wood is greater than the supply.

Grade Level: Upper elementary

Subjects: Math, science, social studies, language arts

Skills: Adding, subtracting, working in cooperative groups, interpreting data, poetry writing

Introduction: People rely on wood from trees to heat their homes, cook their food, and provide building materials and paper for homes, schools and businesses. The more people there are, the greater the demand for wood. While it takes only seconds to cut down a tree, it takes years to grow a new one. We also depend upon forests to regulate climate, clean air and water, conserve precious soil and provide homes for many birds and animals. In almost every part of the world, trees are being cut down at a faster rate than they are being replaced.

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TIMBER!

6. Stop at the end of the first minute of the game and let the lumberjack remove one tree from the forest. The tree represents the amount of wood the world needs for heating, cooking and building materials at its present population.
7. Continue the game. At the end of each succeeding minute, the world's demand for wood doubles as a result of a growing population. At the end of the second minute, the lumberjack cuts two trees from the forest; at the end of the third minute, the lumberjack cuts four trees from the forest, and so on.
8. End the game when the wood reserves in the forest can no longer meet the demands of the lumberjack.

Discussion Questions:

1. How many minutes did it take for the lumberjack to cut all the trees in the forest?

   Just over seven minutes. At seven minutes there would only be 21 trees left.

2. Was the forest always shrinking? Explain.

   No. After the first minute, the forest increased by two trees and stabilized for another minute. After the third minute, the doubling of forest use led to the end of the forest.

3. If the forest manager could develop a tree that grows at a rate of one tree per second, would tree growth keep up with the timber demand? Why not?

   No. The doubling of forest use due to increased population size would still lead to the demise of the forest. If the simulation was done with 60 sticks given to the forest each minute, it would only increase the life of the forest by two more minutes.

4. What could be done to prevent the demise of the forest?

   The forest can only be maintained if we only cut down what can be replaced. This means conserving our use of tree products such as paper and lumber. However, if the human population continues to grow, these items will always be in greater demand.

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TIMBER!

Follow-up Activities:

1. Have students read the book or watch the video of *The Lorax* by Dr. Seuss and go through the discussion questions in the next activity, *Lessons from the Lorax*.
2. Poet Ogden Nash wrote the following verse to describe his feelings about the beauty of trees and the danger they are in:

   "I think that I shall never see

   A billboard lovely as a tree.

   Indeed, unless the billboards fall,

   I'll never see a tree at all."

   Invite students to write their own short verse about trees. This could be in the form of a limerick, haiku or any other rhyming or nonrhyming verse.
3. Lead a brainstorming session with students on ways to conserve paper at home and in school in order to save trees. Write these on the board and try to implement the more practical ideas in the classroom, such as using both sides of paper.

Timber! originally appeared in *Two Cans and Toucans: Exploring Shrinking Habitat* developed by Biological Sciences Curriculum Study (BSCS), Colorado Springs, CO for The National Science Foundation's National Science and Technology Week packet, ©1990.

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Concept: Economic demands can lead to excessive use of natural resources, and population growth can add to environmental stress.

Objective: Students analyze the interdependencies demonstrated in a fictional story of rapid development in a formerly undisturbed environment.

Grade Level: Lower and upper elementary

Subjects: Science, social studies, language arts

Skills: Reading comprehension, story analysis

Introduction: *The Lorax* by Dr. Seuss (Random House, ©1971), is the story of a beautiful woodland's destruction as economic demands lead to excessive use of its natural resources and rapid population growth adds to the environmental stress. You can use this story to introduce students to a variety of concepts related to population growth in a most entertaining way.

ACTIVITY 28

LESSONS FROM THE LORAX

Materials:

The Lorax by Dr. Seuss (book or video). The video version of *The Lorax* is available for rent at many video stores. It can be purchased from **ecol-o-kids**, 3146 SW Shadow Lane, Topeka, KS 66604; (913) 232-4747 for $13.95 plus $3.00 shipping and handling. *The Lorax* book is available in the children's section of most major bookstores and libraries.

Procedure:

First, read *The Lorax* to your class or show them the animated, musical video. Then discuss the following questions related to the story with your students:

1. Why did the Once-ler make so many thneeds?
2. How were the animals and birds affected when the truffula trees were cut down?
3. Why did so many more Once-lers move to the area?
4. How did the rapid population growth affect the environment?
5. Think about the imaginary land in *The Lorax*, as it was before the Once-ler arrived. Did it remind you of any real place you have seen? Now think about how it looked after the population explosion changed the environment. Did it remind you of any real place you have seen?
6. What could the Once-ler have done that would have allowed him to make thneeds but not harm the environment so much?
7. What could the other Once-lers who moved there have done to keep it a nice place to live?

Follow-up Activity:

If your students enjoy *The Lorax*, recommend that they read *The Wump World* by Bill Peet (Houghton Mifflin Co., ©1970). The Wumps lead a peaceful existence in the grassy meadows of Wump World until the Pollutians from Pollutus land on their world and begin changing their environment. This is a classic appropriate for all ages.

ACTIVITY 29

A HOME WATER AUDIT

Materials:

A gallon jug
Sink
Watch with a second hand
A small square of paper for each student
Calculators
A recent *World Almanac*
Student Worksheet (1 per student)

Procedure:

1. Pose the question, "What are some of the different ways we use water on a daily or regular basis?"
2. Write students' answers on the board as they are offered. Possibilities include: Bathing; drinking; cooking (especially boiling things like eggs or pasta); washing dishes, clothing and cars; watering the lawn; filling swimming pools....
3. Ask "How long do you think it takes to fill a gallon jug from the faucet at full power?" Record these answers on the board with the others.
4. Select two volunteers from the class. To the first, give the gallon jug and assign the task of filling it with water from the faucet. To the other, give the watch, and assign the task of timing the filling of the jug. Be sure the whole class watches and records the time on their worksheets.
5. Distribute the small squares of paper and ask, "How many gallons of water do you think you use in a day? Write your name and estimate on this paper and then give it back to me."
6. Assign homework: "At home tonight and tomorrow morning while getting ready for school, whenever you or anybody else in your family is using water, time how long the water runs and write it down on your worksheet. Also, ask your parents/guardian to show you an old water bill and/or how to read the water meter (if you live in a house)."
7. Instruct students to calculate the answers to the questions on the "Classwork" section of their worksheets. Consult a recent edition of the *World Almanac* and write the population totals for your city, state, and nation on the chalkboard.
8. Return to students their estimates from the day before, and ask that they calculate the difference between their estimates and the actual amount of water they used.

Concept: Water is a finite, nonrenewable resource that is necessary to all living creatures. For the survival of every species, including our own, preservation of this resource is crucial.

Objective: Through this activity module, students will learn how much water is available for human consumption and how much water they use, both directly and indirectly.

Grade Level: Upper elementary

Subjects: Science, math, home economics

Skills: Estimating, collecting and using data, multiplying and dividing

Introduction: Though water is a **recyclable** resource (we can to some degree clean and reuse it), it is not a **renewable** one (we will never be able to create more of it.) Our supply is limited, and unlike some other nonrenewable resources, we absolutely cannot live without it. Science might be able to provide us with alternatives to gasoline, for example, but there is no substitute for water. We must be careful in the ways we use and treat it.

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EVERY DROP COUNTS

Discussion Questions:

1. How much water, more or less, did they use per day than they thought? Why might that be?
2. Could we use less water? How?

Follow-up Activities:

1. Put the gallon jug under the classroom faucet set at a slow drip. Ask the class for their estimates on how long it will take to fill the gallon at this rate. The next day, tell them how long it actually took and lead a discussion about it. How much water would be wasted each day by a leaky faucet? Do they have any leaky faucets in their homes? How many times have they seen faucets leaking in public restrooms?
2. Arrange a class trip to the local water treatment plant. Witnessing this process makes a lasting impression about where our water comes from, and where it goes and what it looks like after we've used it.

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EVERY DROP COUNTS

STUDENT WORKSHEET

NAME____ DATE____________

HOMEWORK

1. Amount of time it takes to fill a gallon at full water power________minutes _______ seconds

2. Amounts of time water was running in your home from the time you came home from school to the time you left in the morning.

   a. Getting a drink _______ minutes ____ seconds
      Washing dishes (by hand) ____ minutes ____ seconds
      Showering ____ minutes ____ seconds
      Filling bathtub ____ minutes ____ seconds
      Brushing teeth ____ minutes ____ seconds
      Washing face ____ minutes ____ seconds
      Washing hands ____ minutes ____ seconds
      Other ________________ minutes ____ seconds
      Other ________________ minutes ____ seconds
      Other ________________ minutes ____ seconds
      Other ________________ minutes ____ seconds
      Other ________________ minutes ____ seconds
      Other ________________ minutes ____ seconds

   b. Number of toilet flushes ____ (x 5 gallons per flush)
      Number of loads of laundry ____ (x 40 gallons per load)
      Did the dishwasher run? ____ (x 14 gallons per load)

3. Total time water was running at home ____ minutes ____ seconds

4. Reading of water meter ____ or water bill $____ (if available)

CLASSWORK

5. How many gallons were used at home? ______
   (Answer to question 3 divided by answer to question 1 plus answers to 2b.)

6. What is the average number of gallons used daily per person in your home? ______
   (Answer to question 5 divided by the number of people in your household.)

7. Assuming that everyone uses water at the same rate as each person in your family, calculate how much water is used daily by your:
   a. City ______ (Answer to question 6 multiplied by the number of people in your city.)
   b. State ______ (Answer to question 6 multiplied by the number of people in your state.)
   c. Nation ______ (Answer to question 6 multiplied by the number of people in your nation.)

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EVERY DROP COUNTS

ACTIVITY 30

WATER, WATER EVERYWHERE

Materials:

Blue food coloring
1 large clear container big enough to hold 1 gallon
1 medium clear container big enough to hold 1 cup
4 small, clear containers (test tubes would be ideal, but juice glasses or small plastic party cups from the grocery store would also work)
1 full set of cup measures
1 full set of measuring spoons
Masking tape
Marker

Procedure:

1. Set out all the containers, measuring cups and spoons where the class will be able to see them.
2. With the masking tape and magic marker, make a label for each of the five water categories you'll be discussing: (1) Oceans - 97% (2) Polar Ice - 2.2% (3) Saltwater Lakes, Soil, Atmospheric Moisture, Glaciers - 0.1% (4) Deep Underground - 0.3% (5) Fresh (rivers, lakes, shallow groundwater) - 0.3%. Leave the labels stuck to the edge of the counter until you've filled the containers with the appropriate amount of water, then attach them.
3. Fill the large clear container with exactly six cups of water.
4. Add a few drops of the blue food coloring.
5. Ask "How much of the Earth's surface is covered by water?" *3/4 or 75%*.

   Hold up or point to the large, full container.

   "This represents all of the water on the planet."
6. Scoop three tablespoons from the big container into the medium container. Attach the **"Oceans"** label to the big container and hold it up again.

   "This represents the 97% of the Earth's water that is in the oceans."

   Hold up the medium container.

   "This represents the other 3% of the world's water."
7. From the medium container, measure out two tablespoons and one-half teaspoon and pour into the first small container. Attach the **"Polar Ice"** label and hold it up.

   "This amount represents the 2.2% of the Earth's water that is frozen in polar ice."

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EVERY DROP COUNTS

8. Again from the medium container, measure out one-half teaspoon and pour into the second small container. Attach the **"Saltwater Lakes, etc."** label and hold it up.

   "This amount represents the 0.1% of the Earth's water that is in saltwater lakes, soil and atmospheric moisture, and glaciers."

9. From the medium container, measure out one-half of the remaining water (1 teaspoon) and pour into the third small container. Attach the **"Deep Underground"** label and hold it up.

   "This amount represents the 0.3% of the Earth's water that is deep underground."

10. Pour out the rest of the water (1 teaspoon) from the medium container into the fourth small container. Attach the **"Fresh (etc.)"** label and hold up.

    "This amount represents the 0.3% of the Earth's water that is fresh (rivers, lakes, shallow groundwater)."

Discussion Questions:

1. Which of these kinds of water could we use for the daily purposes listed on the Home Water Audit?

   The 0.3% of fresh water and maybe some of the deep groundwater. (Hold up containers #3 and #4.)

2. What sources of water can't we use for those purposes?

   Salt water, water we can't reach, or polluted water. (Hold up containers #1, #2, and #3.)

3. Do you think it's important for us to be careful with this water? Why?

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ACTIVITY 31

WATERBURGERS?

It's easy to track how much water we use directly from faucets, showers, sprinklers, dishwashers, toilets and so forth. That's when we actually see the water running and we control it by turning it on and off. But lots of water is used to produce things that aren't at all wet by the time they get to us.

For example, hamburger and roast beef aren't watery on your plate. But beef comes from cows, and in its lifetime, a single cow consumes a huge amount of water. It not only drinks thousands of gallons of water directly, it eats about 2,500 pounds of corn. It takes 76 gallons of water to grow a single ear of corn, and it takes six ears of corn to make one pound. Let's do a quick calculation:

76 gal. of water per ear of corn
x 6 six ears per lb.
456 gal. of water per lb. of corn

2,500 lbs. of corn per cow,
x 456 gal. of water per lb. of corn to feed a cow
1,140,000 gal. of water to grow enough corn to feed one cow!

Who would have thought that so much water could go into making hamburger? Many of the products we buy and use and eat every day use up a lot of water while they are being made, as beef does. So, when we add up the water we use, we have to look at our indirect use of it, too

Procedure:

1. Copy "Item" side of the chart below onto the chalkboard. Write the heading "Gallons of Water Used" as well, but do not fill in the numbers or descriptions. Lead the class in a brainstorming session about how water is used in the production of these items:

Item	**Gallons of Water Used**	
1 egg	40	*For the mother hen to drink; to raise grain to feed the mother hen*
1 orange	100	*To water the tree*
1 loaf of bread	142	*To water the grain as it grows in the field before it's ground into flour; to raise the grain to feed the mother hen that provides the eggs used in bread; to raise the sugar used in bread...*
1 kg sugar	275	*To water the sugar cane as it grows*
Sunday newspaper	280	*To mix with the tree pulp to process; to mix with pigment to make ink*

Discussion Question:

Do you think there are ways we could reduce our indirect use of water? What are they? (Example: Each ton of paper recycled saves 7,000 gallons of water.)

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ACTIVITY 32

MINERAL MATCH-UP

Materials: Student Worksheet (1 per student)

Procedure:

Here's a way to get students thinking about how we depend on minerals.

1. Copy the Student Worksheet on page 107 and give one to each student. The worksheet asks students to match up some common household items with the minerals from which they were made. After students have completed the worksheet, go over it as a class.
2. Ask students to name some items which they enjoy using. This might include television, computer games, cassette disks, certain toys and appliances. After listing their suggestions on the board, have the students brainstorm as a class what elements from the ground may have been used to produce each item. For instance, electronic equipment may have a plastic shell (a petroleum product), copper wiring, etc. Some of them may be obvious; others they may have to look up in the encyclopedia. You could extend this as a library activity for finding out some of the answers.

Concept: Minerals are finite, nonrenewable resources we depend on for many products in our daily lives. Conservation of minerals is critical so that we have enough to last for the future and so that we do not destroy precious land for mining operations.

Objective: Students will gain an appreciation of how many items come from materials mined from the Earth. Students will learn how mining operations can affect the land.

Grade Level: Upper elementary

Subjects: Science, social studies, math

Skills: Drawing connections, fine motor skills, brainstorming

Introduction: Nonrenewable resources are those which can never be replaced once they are used up. Our Earth is rich with minerals which we depend on to produce so many products we use every day, from the building materials of our homes, cars and appliances to our food containers, tires, cleansers and art supplies. Some minerals are very common and others are very scarce. As the human population grows, the demand for minerals grows as well. Mining for minerals takes place all over the world. Often, these mining operations damage the land.

Student Worksheet Answers: *1.E, 2.L, 3.M, 4.P, 5.D, 6.N, 7.A, 8.B, 9.O, 10.K, 11.C, 12.H, 13.F, 14.Q, 15.J, 16.G, 17.I*

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ACTIVITY 33

MINING FOR CHOCOLATE

Materials:

Hard chocolate chip cookies (one per student)
Toothpicks
Napkins

Procedure:

1. Distribute the cookies to the students (but they mustn't eat them!) Tell them that the cookies represent the land and the chocolate chips represent minerals, like coal, which they will be mining from the cookie. Ask students to estimate how many chips are in their cookies.
2. With their toothpicks, students will attempt to extract the chips from the cookie, trying to do as little damage to the cookie as possible. Cookies should stay flat on a napkin or plate, as hills cannot be picked up. After a few minutes of mining, ask students if they wish to change their estimate of how many chips are in their cookies.
3. After students have completed the activity, ask them to share the difficulties they had with their mining operations with the class. Ask them to predict whether mining companies might have the same kinds of difficulties.
4. Have students brainstorm ways to reclaim their land (the cookies). Can the cookie be put back together? (Remind students that most of the soil and rocks mined are sterile and plants can't grow in it.)
5. Eat the cookies!

Follow-Up Activity:

Because minerals are nonrenewable resources, they need to be conserved and recycled so that we don't run out of minerals that are in short supply. Select several of the minerals listed on the Student Worksheet and ask students to offer suggestions on how these elements might be conserved. For instance, tin and aluminum cans are often recycled as part of curbside recycling programs. Tin cans can be washed and reused as containers for pennies or paper clips. Gold can be melted down and redesigned for other uses. Aluminum cans can be remade, saving 95% of the energy used to make new cans from newly mined aluminum.

*Adapted with permission from *OUTLOOK, Environmental Education Enrichment*, published jointly by the Iowa Natural Heritage Foundation, the Iowa Department of Education and the University of Northern Iowa, ©1983. Direct inquiries to David V. McCalley at the Institute for Environmental Education, McCollum Science Hall, Cedar Falls, IA 50614-0421.

TREASURES UNDERGROUND

STUDENT WORKSHEET

NAME____DATE____________

All of the items listed below are made of minerals mined from the ground. In the blank to the left of the items listed, write the letter of the element from which these items were made. The elements are listed at the bottom of the page.

1._____ Soup cans
2._____ Matches, gunpowder, rubber
3._____ Watches, radios, televisions, radar instruments
4._____ Pencil
5._____ Bricks, pottery, tennis courts
6._____ Pennies, stereo wire, brass instruments
7._____ Wedding band, first-place medal, nuggets
8._____ Soda pop cans, foil wrap, baseball bats, house siding
9._____ Horseshoe, hammer, steel products (cars, eating utensils, swords)
10.____ Food seasoning and preserver
11.____ Plastics, heating fuel, gasoline, vinyl, synthetic fabrics
12.____ Old five-cent coins, paper clips
13.____ Baby powder, crayons, soap
14.____ Jewelry, drill bits
15.____ Charcoal, tar
16.____ Pipes, old paint, X-ray shields
17.____ Flatware (forks, knives, spoons), jewelry, second-place medal

A. Gold
B. Aluminum
C. Oil (Petroleum)
D. Clay
E. Tin
F. Talc
G. Lead
H. Nickel
I. Silver
J. Coal
K. Salt
L. Sulfur
M. Quartz
N. Copper
O. Iron
P. Graphite
Q. Diamonds

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SOMETHING FOR EVERYONE

Concept: Sustaining our natural resource base requires observation and the cooperative use of resources held in common.

Objective: In a simulation, students desiring to draw renewable resources from a common pool determine short-term consumption strategies that will preserve a long-term supply of the resource.

Grade Level: Upper elementary

Subjects: Social studies, science

Skills: Finding cooperative strategies, following directions

Introduction: In this game, students will be simulating what happens when people compete for limited resources. Because the chips in the game represent renewable resources, students will be encouraged to find cooperative strategies which will result in an equitable distribution and conservation of the resources (chips). When first playing the game, it is best not to give students an introduction linking the chips to resources. This will come out during the game and discussion period.

ACTIVITY 34

SOMETHING FOR EVERYONE

Materials:

Cardboard or plastic poker chips or peanuts in the shell. About 10 chips per student should be available altogether.
Candies, decals, or something the students value highly
Stopwatch or watch with a second hand
Record, CD or tape player for playing music
Record, CD or tape of lively music (at least eight minutes of continuously playing music)

Procedure:

The students sit in a circle (or two circles if there are more than 15 students). In the center of the circle, at least three feet away from the closest student, place one-fourth of the chips. (For example, if you have 10 students, you use 100 chips and begin with 25 in the center of the circle.) Read the following rules carefully to the students. Allow time for questions and answers to make sure students understand the rules of the game thoroughly.

Rules:

1. The chips belong to all of you.
2. Music will be played, and while it is playing, everybody may take chips out of the pool of chips in the center.
3. You may trade in 10 chips for a piece of candy (or decal).
4. As soon as the music stops, I will double the number of chips left in the pool at that time, and then continue the game.
5. There will never, however, be more chips in the pool than there are at the start of the game; this is the maximum number of chips the pool can hold.
6. You may not talk to anyone during the game.

Notes to the Teacher:

The length of time that spans between doubling the pool can be varied, but should be consistent within each game. Try 30 seconds to begin with.

The number of chips after doubling should not exceed the initial number in the pool (its "carrying capacity").

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SOMETHING FOR EVERYONE

In all likelihood, the pool will be depleted before the music stops. Repeat the game two times without giving the students time to communicate with one another in between.

After that, collect information about what happened and have students report on their feelings (see the following discussion questions). As a group, help the students think of ways they could cooperate to allow more of them to get their 10 chips without depleting the pool of resources. Play again using these strategies developed by the students.

Discussion Questions:

1. How long did it take in every game until the pool was empty? (Have one student or onlooker take notes.)
2. How many chips were taken out of the pool in each of the different game variations? How many candies (or other rewards) did this generate?
3. How did talking about the game make you play differently? How did it make you feel about other members of the group?
4. Did you feel like you had different reasons for playing the game after talking about strategies? Do you think other participants had different reasons for taking the chips? How did this make you feel?
5. Have you experienced a similar situation at home, with friends, in your community? (You may wish to provide an experience of your own to help students see the similarities, such as several people in the house competing for the hot water in the morning.)
6. Discuss how, in the long run, more can benefit if the individual refrains from taking too much, and what attitude is needed among the individual members to achieve the goal of the greatest benefit for all.
7. Make a parallel between the chips and candies, and a forest and tree usage (for paper and wood products).
8. Discuss similarities with other renewable resources and their use or overuse by individuals such as depletion of clean air and water, overuse of land and worldwide food consumption.

Something for Everyone was adapted by permission from an activity developed by Kurt and Ursula Frischknecht and Karen Zimbelman in *Thinking Globally and Acting Locally: Environmental Education Teaching Activities* by Lori D. Mann and William B. Stapp, ERIC/SMEAC, ©1982.

MORE OR LESS

Concept: Population growth is closely linked to many environmental and social issues.

Objective: Students construct a word web to show the possible cause-and-effect relationships of having a growing population.

Grade Level: Upper elementary

Subjects: Science, language arts, social studies

Skills: Drawing connections, understanding cause-and- effect relationships

Introduction: "Everything is connected to everything else" is the first law of ecology. This is an important concept when making decisions about ourselves, our future and the resources we depend on. This activity demonstrates the many cause-and-effect relationships that can be drawn between the human population, resources and the environment.

ACTIVITY 35

MORE OR LESS

Materials:

Word list
Construction paper
Colored markers
Yarn or masking tape
Bulletin board and pins
Magazines (optional)

Preparation:

Cut construction paper into 3″ x 11″ strips. Write each word from the Word List on a paper strip with a colored marker. Then print the word "MORE" on enough paper strips to supply half the class. Make "LESS" cards for the other half of the class in the same fashion.

Procedure:

1. Randomly distribute the cards so that each student has either a "MORE" or a "LESS" card. Then display the other word cards so that all the students can see them. You may want to lay them out on a table or desk at the front of the room.
2. Begin making a word web by pinning or taping the words "MORE PEOPLE" on the board. Ask the students, "If there are more people, what else might we have more or less of?"
3. Invite a student to pick a card to make another phrase that would logically follow "MORE PEOPLE," such as "MORE CARS." Have the student pin these two words to the bulletin board. Use strips of masking tape or lengths of yarn to "connect" the two phrases. If cards are taped to a chalkboard, draw arrows between them to show cause-and-effect. Make sure the students understand the difference between having more and needing more. Have them explain the connection to the class.
4. Then invite other students, one by one, to pick word cards to complete logical statements. Example: "MORE CARS" (mean) "LESS OIL" (available). See how many phrases can be logically linked to the first phrase. Or see how many phrases can be linked to other phrases.

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MORE OR LESS

Follow-up Activity:

Have students cut pictures from magazines to help illustrate the words, phrases and relationships. Are all the relationships as clear-cut as they are stated? For instance, must more factories mean more noise, more pollution, or more jobs? Do more houses always mean less wildlife habitat or more human habitat? Under what circumstances would the relationships change? Discuss the web concept in showing that "Everything is connected to everything else." Develop your own word list and try the activity again.

Word List

People
Pollution
Clean Air
Illnesses
Inventions
Hospitals
Injuries
Food

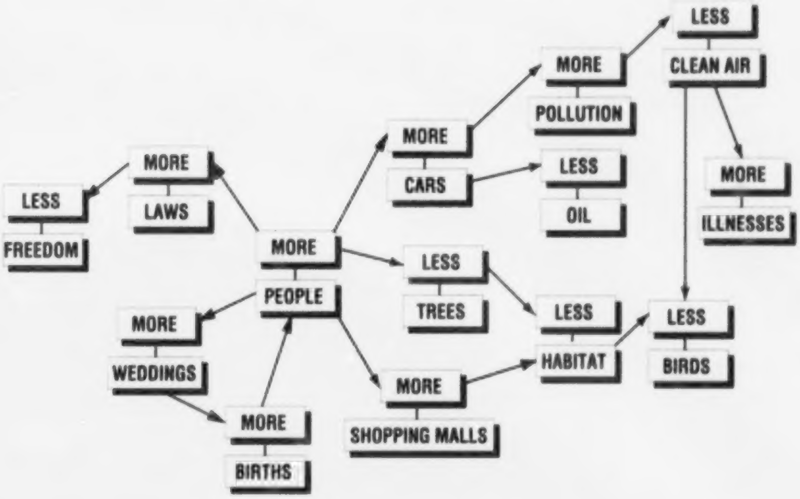
Births
Habitat
Money
Land
Garbage
Minerals
Wars
Soil

Deaths
Jobs
Cars
Oil
Roads
Noise
Fish
Endangered Species

Water
Houses
Freedom
Drought
Schools
Boats
Trees
Shopping Malls

Gasoline
Factories
Accidents
Laws
Weddings
Robberies
Birds

Example:



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COUNTING ON PEOPLE

PEOPLE AND WASTE

BEST COPY AVAILABLE

HOW DO PEOPLE CREATE SO MUCH WASTE?

In the last chapter, students learned that we need to have a balance of people and resources and that we can all contribute to resource conservation. Whenever resources are consumed, there are by-products created, often in the form of pollution and garbage. In this chapter, students will learn about some of the ways we have an impact on the environment in our everyday lives when we use resources. They will also find clues on simple ways to lessen these impacts.

Before beginning these activities, go over the following information with your students.

> You may never have thought about it, but whenever we use resources, we create waste. For example, when we burn fuel in our homes, cars and factories, it creates smoke which pollutes the air. When we buy food, there is often a lot of packaging—boxes, bottles, plastic wrap—which must be thrown away. And sometimes, when new products are made, harmful chemicals are also produced. Where do these wastes go?
>
> We can put garbage in big holes in the ground, called **landfills**, but they take up lots of space. We can burn it, but this creates more air pollution. We can dump it in the ocean, but this pollutes the water and kills the fish. We must be especially careful about where we put chemical (hazardous) wastes, so they don't pollute our water, land or air.
>
> The more people there are, the more waste is created. More people drive more cars which make more air pollution. And more people use more of so many items which generate waste. In the United States, each person creates about four pounds of garbage each day. That's 1,460 pounds of garbage each year!
>
> Each of us can help cut down on the amount of waste. We can think about ways to reuse or recycle items before simply throwing them away. Or maybe we can cut back on some of our waste-producing activities by using cars less often, by buying products with little packaging, or by remembering to turn off lights and other electrical items.

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The Rap on Garbage

Too much garbage.
Not enough space.
Got to be careful
Not to replace
Tulips with tin cans.
Meadows with glass.
Forests with dump grounds.
Fresh air with gas.
Reuse or recycle.
Don't throw things away.
Let's make a new start here.
Begin a new day.
From the depths of the ocean
To the top of the Alps.
Every litter bit hurts.
Every little bit helps.

By Sandy Stryker from Mother Nature Nursery Rhymes
Advocacy Press. Santa Barbara. California ©1990. Reprinted with permission

WASTE A-WEIGH

Concept: Reducing the amount of garbage each one of us creates can help solve our nation's waste disposal problems.

Objective: By weighing and recording their waste at lunch every day for a week, students learn how conservation efforts can reduce the total amount of trash generated.

Grade Level: Lower and upper elementary

Subjects: Science, social studies, math

Skills: Applying math concepts, practicing conservation, analyzing trends

Introduction: Each American generates an average of four pounds of garbage each day. As the U.S. population grows, so does the amount of garbage. The problem is that we are running out of places to put the garbage. The U.S. Environmental Protection Agency estimates that 80 percent of our landfills are already full. And burning trash creates harmful pollution. Americans are being encouraged to "reduce, reuse and recycle" their garbage in an effort to help solve our waste disposal problems. The first part of this formula, "reduce," means that we have to try to find ways to create less waste. In this activity, students are asked to try their waste-reducing skills in the school cafeteria. This activity can become a lively competition between classes.

ACTIVITY 36

WASTE A-WEIGH

Materials:

A scale to weigh the garbage (you might want to pre-adjust it with the weight of one cafeteria tray and place the trash on the tray)
Student worksheet (1 per student)

Procedure:

1. The Friday before you plan to do the activity, tell the class that they will participate in an experiment concerning waste production during the following week. Explain that the waste students generate during lunch will be recorded for the entire week. Encourage students to bring or buy their usual lunch on Monday in order to gauge their conservation progress as their awareness of their consumption patterns grows throughout the week.
2. Each day of the following week, set up a weighing station in the cafeteria and require all your students to weigh any items that they plan on throwing away, including food wastes, packaging, bottles, etc. Record the weight of each student's trash, and later transfer the amounts to a chart in your classroom. This chart should also include the total weight of all trash generated by the class that day.
3. Sometime during the beginning of the week you might want to give students hints on how to reduce their waste. Suggestions may include: only buying as much food as they plan to eat, avoiding items with excess packaging, bringing reusable containers from home, and recycling glass, aluminum and plastics.
4. At the end of the week, have each student fill out the worksheet included with this activity. Ask students which conservation methods seemed to be most effective. Which were most convenient? Which do they think would be best to implement on a school level? On a community or city level? Nationally? Also, have students brainstorm about specific ways the practices in their cafeteria could be changed. For example, see if the art department would like some of the containers, or see if local farmers could use food leftovers for compost or to feed animals.
5. For upper elementary students, have them try the Bonus Questions on the Student Worksheet. *Answers: 1,040,000,000 lbs.; 379,600,000,000 lbs.; 480,000,000 lbs.; 172,200,000,000 lbs.*

WASTE A-WEIGH

Note: In some schools, lunchtime is too limited for each student to weigh their waste. In this case, just do this activity as an entire class, weighing one garbage bag after all the students have discarded their waste. Then the class can challenge itself to reduce their waste the next day or challenge another class to see who can create the least amount of waste.

Follow-up Activities:

1. Once students have learned some conservation techniques, they may wish to challenge another class to a competition to see who can average the least amount of waste. The competition could be expanded to different grade levels, or even different schools in the area. Local newspapers and magazines might be interested in featuring such a competition in their publications, especially with suggestions from students about ways for the community to decrease waste generation.
2. To give your students more information on garbage production and what each of us can do to reduce, reuse and recycle, show students *The Rotten Truth*, a 3-2-1 Contact Extra Video appropriate for ages 8-12.
   The video is available from Sunburst, 1600 Green Hills Road, Scotts Valley, CA 95067-0002.

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WASTE A-WEIGH

STUDENT WORKSHEET

NAME________________________________DATE__________

	Mon.	Tue.	Wed.	Thurs.	Fri.
Personal Waste (ozs.):	____	____	____	____	____
Class Waste (lbs.)	____	____	____	____	____
Class average (lbs.)	____	____	____	____	____

Did you have more or less waste than the class average?

Did you and/or the class create less waste as the week went on?

How much less? (Subtract the last day from the first to discover the amount saved.)

You ____

Class ____

If the whole school followed the same conservation patterns, how much garbage would be avoided?

In one day? _____

One month? _____

The school year? _____

Bonus:

Each American creates about four pounds of garbage each day. U.S. population in 1994 was 260 million people. How much garbage is created by everyone in the country in one day? How about in one year?

The U.S. population is expected to increase by 120 million people by the year 2050. How much more garbage would be created each day? How about each year?

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WASTE NOT, WANT NOT

ACTIVITY 37

WASTE NOT, WANT NOT

Materials:

Large boxes or crates to collect throw-away items
Small bags
Refreshments (optional)

Procedure:

PART 1: FROM TRASH TO SCHOOL SUPPLIES

Many household items routinely discarded in students' homes would be very useful to teachers and other students seeking low-cost supplies for classroom activities and school projects. Here is an event students can plan and carry out to both demonstrate the desirability of recycling and provide teachers and students with supplies they need.

1. Included in this activity is a sample flyer which can be adapted for your event. Share the list of items on the flyer with your students and ask if there are any additional "throwaway" items they believe teachers or students could use if they were made available in quantity. You might want to ask teachers this question, too.
2. Ask students to begin saving items on this list that would otherwise be thrown away by their families. Large boxes or crates should be provided to serve as collection bins. Ideally, students should encourage the entire student body and faculty to contribute to the collection bins, and perhaps appeal to parents through a newsletter, a flyer sent home with students, or at a PTA or home and school association meeting. Students should also encourage teachers and other classmates to think about how they can use items from the list for their various projects.
3. On the day of the event, be sure all bins are clearly labeled and bags or boxes (recycled, of course) are provided for items taken by participants. Students should be on hand to assist participants in finding what they need. If you like, refreshments may be served as a further enticement to participate (using nondisposable supplies, if possible).

PART 2: THE CREATIVE RECYCLER

1. Select one item from the list on the flyer and have the whole class brainstorm possible ways the item can be reused. Creativity is strongly encouraged; no suggestion is too absurd to be included during brainstorming! After the brainstorming session is finished, the class can go back over the list and eliminate suggestions that seem impractical.

Concept: Many of the items people typically thrown away can be reused. Reusing items reduces the solid waste problem by reducing the demand for new items to be manufactured.

Objectives:

a. Students identify ways to reduce the amount of solid waste produced by using fewer disposable items and reusing items that might otherwise be thrown away.

b. Students promote recycling to other students, faculty and their families.

Grade Level: Lower and upper elementary

Subjects: Science, social studies, home economics

Skills: Planning an event, creative writing, brainstorming, recycling

Introduction: This unit includes three parts:
(1) a school-wide event that promotes recycling while providing teachers and students with needed supplies;

(2) a creativity exercise to identify ways commonly discarded household items might be productively reused;

(3) a no-waste party.

It is suggested that the class do the "Creative Recycler" activity while they are gathering the materials needed for the school-wide recycling event. When the event is over, they can celebrate with the no-waste party.

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WASTE NOT, WANT NOT

2. Have each student (or pair or small group of students) select one or more items on the list and note creative ways the item or items might be recycled. If you prefer, assign this as a creative writing project, such as "My Memorable Year as a Yogurt Container." Students might also create illustrations of some of their suggestions to exhibit on a display at the recycling event. The students' suggestions, stories and illustrations may inspire teachers and other students to consider new ways they might use these "throwaway" materials.

PART 3: A NO-WASTE PARTY

Have the class plan a party or picnic that produces little or no waste. Challenge students to plan the event to use nondisposable or recyclable items for everything from decorations to refreshment supplies. Be sure the class takes responsibility for actually recycling or composting any items that might otherwise become waste.

This activity reinforces two ideas: (1) that things thrown "away" don't actually go away but do go somewhere; and (2) that students can exercise choice about the way they use resources.

Follow-up Activity:

Have students plan and carry out a Community Information Night to present to parents and others in the community what the class has been doing to reduce waste. It may be billed as an evening of community involvement, where refreshments are served and everyone has an opportunity to learn how they can contribute to a cleaner community. Students may display and describe their class projects and perhaps present (and/or hand out) a list of ways everyone can help reduce solid waste and protect the environment.

MY LIFE AS A YOGURT CARTON. CHAPTER ONE...

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ONE PERSON'S TRASH IS ANOTHER PERSON'S TREASURE!

Teachers, students: Come one, come all—to the recycling event of the year!

STASH THE TRASH NIGHT

Lafayette School Media Center
October 18, 1995; 6 - 8 p.m.

- Student environmental education projects will be displayed, refreshments will be served, and everyone will receive a list of ways they can help solve our community's trash disposal problems.
- Come for entertainment,involvement, and great supplies!
- Collect valuable supplies for your school projects from our bins stocked with goodies rescued from students' and teachers' homes.
- We will have bins full of the following items, all clean and ready to be used again for your school projects:

juice cans and their lids
plastic yogurt containers/lids
margarine tubs (and other plastic containers) and lids
coffee cans and lids
baby food jars and lids
35mm film canisters and lids
toilet paper rolls
paper towel rolls
egg cartons
plastic milk bottle lids
paper bags — all sizes
plastic shopping bags
coffee scoops
6 oz. cat food/tuna cans
styrofoam meat trays
plastic lids
milk cartons
shoe boxes
small boxes with covers
magazines and catalogs with colorful pictures
popsicle sticks
newspaper
rubber bands
wood scraps
wallpaper scraps
fabric scraps
buttons
socks (unmatched okay)
mittens (unmatched okay)
plastic forks, knives, spoons
ribbon, yarn, string
unused stickers and stamps
crayons (broken okay)
corks
bottle caps
hangers
shirts that button down the front
styrofoam packing materials
rug scraps
cardboard
oatmeal boxes
clay or plastic flowerpots
aluminum pie plates
plastic trays from microwavable prepared foods
aluminum trays from frozen dinners

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CATCHING POLLUTION

Concept: The more we use cars, the more we pollute our air. Finding other modes of transportation is important in protecting the quality of the air we and all other creatures have to breathe.

Objective: Students "catch" pollution on prepared cards posted around town to see the environmental and health-related consequences of relying so heavily on cars, and to provoke thought about avoiding and/or reducing this dependence.

Grade Level: Lower and upper elementary

Subjects: Science

Skills: Observing, collecting and analyzing data

Introduction: There are many kinds of pollution. Some we can prevent or avoid; we can pick up litter and try not to drink impure water. But we can't avoid the pollution in the air we breathe; often we can't even see it.

ACTIVITY 38

CATCHING POLLUTION

Materials:

3" x 5" index cards
Hole punch
String
Tape
Vaseline
Magnifying glass

Procedure:

1. Punch a hole at the ends of some 3" x 5" index cards so students can hang them up using a piece of string. Use tape to fasten others.
2. On the back of each card, note the place the card will be left.
3. Explain to the class that these cards will record the amount of visible pollution in the air in different places around the school. Spread a thin layer of Vaseline across one side of each card.
4. Think of some places around the school grounds for the class to leave the cards undisturbed for a week. Ask the class for suggestions. Possibilities include: hanging from branches or railings; taped to windows; taped near a garage or the bus loop; taped to a kitchen or a classroom wall.

   Take the students with you to hang the cards in various locations. Ask them which cards they think will be the dirtiest when you collect them. (On your way home from work, you could hang a few cards yourself in areas with more traffic, such as the back of a STOP sign or the bottom of a streetlight or lamppost at a busy intersection in town.)
5. At the end of the week, collect the cards. Use a magnifying glass to see what's on the cards. (In some cases, the dirt will be visible without one.) Whatever has stuck to the cards is a record of the week's visible air pollution in that place.

Discussion Questions:

1. Which card was the dirtiest? The cleanest? Why do you think that's so?

   Hint: The cards which were posted near high traffic areas are likely to be the dirtiest from the exhaust of cars and other vehicles, especially buses and trucks which burn diesel fuel.

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CATCHING POLLUTION

2. Think about the cards you taped to areas where cars go by. What would happen to the card if twice as many cars went by?

   The card would be twice as dirty.

3. What sorts of things get dirty as a result of car pollution?

   Buildings, statues, animals, plants, trees, people, etc.

4. Could we cut down on how much we use cars? How?

   Walking and riding our bicycles, carpooling or taking public transportation whenever possible instead of using cars.

5. Other than cutting down on air pollution, what good reasons are there for using cars less often?

   Using less oil and gasoline and getting exercise by walking and riding bicycles.

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PEOPLE AND ANIMALS

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WHERE HAVE ALL THE ANIMALS GONE?

Respect for other living things is an important concept for students to understand. The way we live and the resources we use don't only affect other people; they affect animals too. Most young people like all sorts of animals, but they may not realize that many of these beloved creatures are threatened by human actions. In this chapter, students will learn that animals also have basic needs. These needs cannot be met if humans take away their habitats.

Before beginning these activities, go over the following information with your students.

> One of the wonderful things about our world is that we share it with all kinds of other creatures—mammals, birds, fish, insects and reptiles, to name a few. Each of these creatures has a **habitat,** the place where it lives. An animal's habitat provides it with all that it needs to survive, such as food, space, shelter, water and the proper climate.
>
> Sometimes people destroy animal habitats to make more space for people to live, grow food or build more homes, shops and roads. If a forest is cut down, all the animals that lived there lose their homes. If a swamp is drained of its water, some birds who nest there have no place to go. Without their habitat, animals cannot survive. As the numbers of people have increased, the numbers of other animals and plants have decreased because more and more of their habitats have been turned into habitat for people.
>
> Also, animal and plant habitats can be destroyed by the way people use resources and dispose of waste. Land can become uninhabitable for many creatures if the water, air and soil become polluted. For instance, when an oil tanker spills oil into the sea, fish, birds, mammals, and plants become sick and can die.
>
> Sometimes people illegally kill animals to sell parts of their bodies for money. This is called **poaching**. For instance, elephant tusks are sold to make ivory jewelry and alligator skin is made into shoes and belts. Most countries have laws against poaching, but each of us can do our part by not buying products made from wild animals.
>
> It is important for people to work to protect all sorts of wildlife—from the cuddly panda bear to the creepy, crawly insects and snakes. Every plant and animal is special and many improve our lives in all sorts of ways. For instance, many tropical plants contain medicine to cure human diseases. And plants provide us with the oxygen we need to survive and the food we eat.
>
> If we destroy other species through our actions, we upset the delicate balance in our ecosystems. In the food chain, larger animals eat smaller ones. Spiders control the population of flies and cats help control the population of mice. The lives of all living creatures are connected in different ways. When a species becomes **extinct** (dies off forever), there will never be another one like it.
>
> In order to protect all sorts of species, we must respect their habitats and give them the space to live that we know is important for survival.

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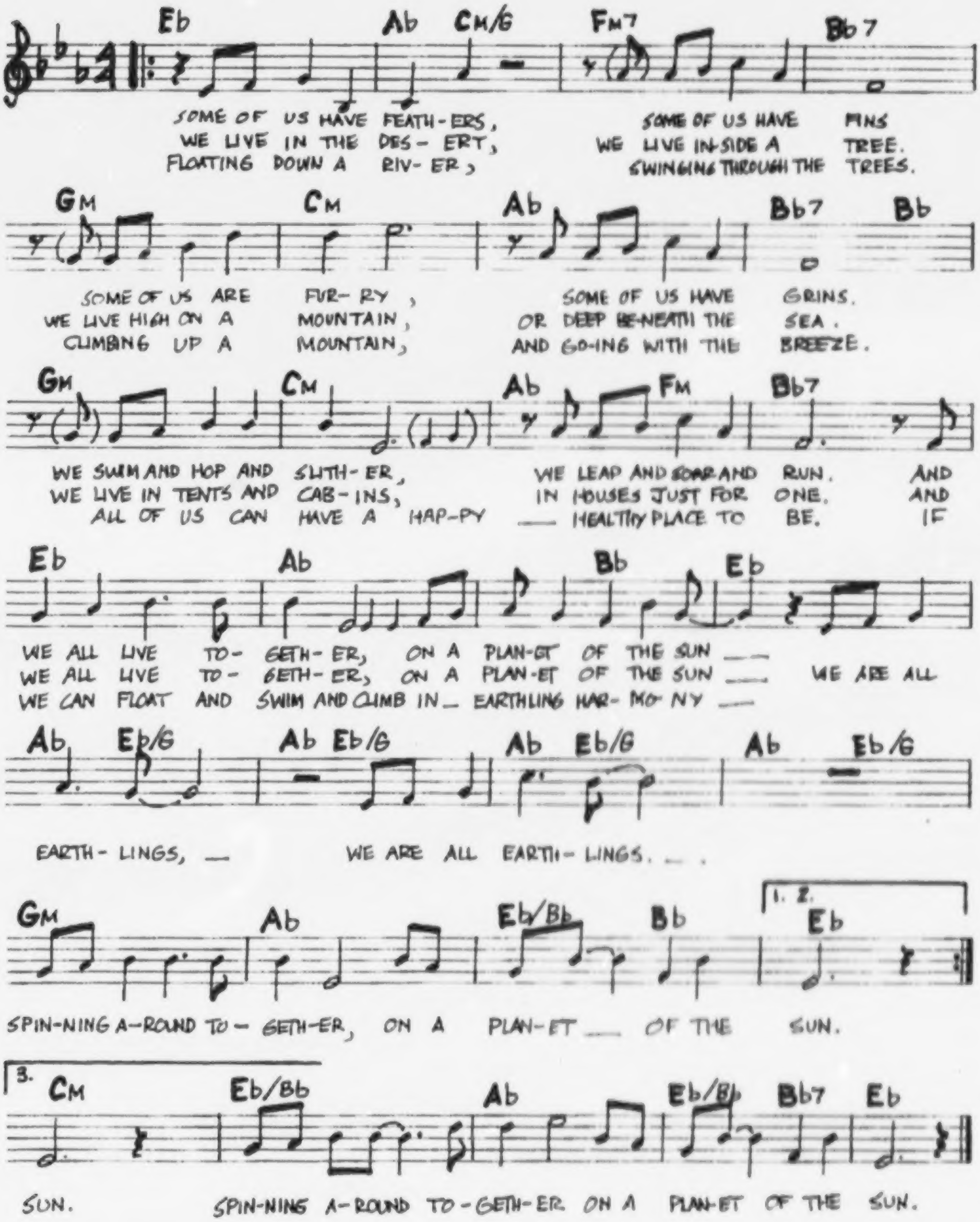
We Are All Earthlings

Words by Sara Compton, Music by Jeff Moss


Eb Ab Cm/G Fm7 Bb7
SOME OF US HAVE FEATH-ERS, SOME OF US HAVE FINS
WE LIVE IN THE DES- ERT, WE LIVE IN-SIDE A TREE.
FLOATING DOWN A RIV- ER, SWINGING THROUGH THE TREES.
Gm Cm Ab Bb7 Bb
SOME OF US ARE FUR- RY, SOME OF US HAVE GRINS.
WE LIVE HIGH ON A MOUNTAIN, OR DEEP BE-NEATH THE SEA.
CLIMBING UP A MOUNTAIN, AND GO-ING WITH THE BREEZE.
Gm Cm Ab Fm Bb7
WE SWIM AND HOP AND SLITH- ER, WE LEAP AND SOAR AND RUN. AND
WE LIVE IN TENTS AND CAB- INS, IN HOUSES JUST FOR ONE. AND
ALL OF US CAN HAVE A HAP-PY — HEALTHY PLACE TO BE. IF
Eb Ab Bb Eb
WE ALL LIVE TO- GETH- ER, ON A PLAN- ET OF THE SUN —
WE ALL LIVE TO- GETH- ER, ON A PLAN- ET OF THE SUN — WE ARE ALL
WE CAN FLOAT AND SWIM AND CLIMB IN — EARTHLING HAR- MO- NY —
Ab Eb/G Ab Eb/G Ab Eb/G Ab Eb/G
EARTH- LINGS, — WE ARE ALL EARTH- LINGS. —
Gm Ab Eb/Bb Bb
1. 2.
Eb
SPIN-NING A-ROUND TO- GETH-ER, ON A PLAN-ET — OF THE SUN.
3.
Cm Eb/Bb Ab Eb/Bb Bb7 Eb
SUN. SPIN-NING A-ROUND TO-GETH-ER ON A PLAN-ET OF THE SUN.

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HABITAT IS HOME

Concept: No species can survive without suitable habitat, and sometimes human numbers and activities can spoil or destroy the habitats of other species.

Objective: Pictures facilitate discussion and awareness of the ways in which plant and animal habitats are being changed.

Grade Level: Lower elementary

Subjects: Science, social studies

Skills: Observing, deductive reasoning

Introduction: Forests, beaches and other places where we go for fun are home to lots of plants and animals. When there are so many of us that we need new schools and hospitals and houses and so forth, we clear these areas so that we can build on that land. We should think about what that means for creatures who already live there.

ACTIVITY 39

HABITAT IS HOME

Materials:

Pictures of deserts, rainforests, prairies, oceans, coral reefs, and other habitats and endangered animals that live in them. (*National Geographic*, *Life* and similar magazines are possible sources.)
Drawing paper and crayons (optional)
Copies of illustrations provided
Pencils or markers

Procedure:

1. Begin by introducing the term **habitat**. "It is the area where an animal or plant lives and obtains food, water, shelter and living space."
2. Show the class some pictures of different habitats. Explain that plants and animals find everything needed to survive within these habitats.
3. Ask, "What are some of those things that animals and plants need to survive?" List their suggestions on the chalkboard. They should be aware that most living things need food, water, space, shelter, sunlight and air. (You could reinforce the concept of habitat by having students draw a scene featuring a forest, meadow, or other type of familiar habitat in your area and some of the plants and animals that live there.)
4. Discuss some of the animals and plants in the photographs and the reasons they are endangered. Explain that the main reason many species are in trouble is that their habitats are being changed by people's numbers and activities.
5. Pass out copies of the illustrations on page 130. Point out that each of the large pictures in the middle represents a way people are changing plant and animal habitats. The smaller pictures at the top and bottom show some of the reasons why people alter habitats.
6. Instruct the class to look at Picture 1. Ask them what's happening in the picture. (People are filling a wetland or swamp.) Can they find any of the smaller pictures that show why people might fill or drain wetlands? (For space to put in roads and to create land for farms.) As you go over the reasons, have students draw lines from Picture 1 to the smaller pictures. Can they think of some animals that live in wetlands? (Fish, alligators, frogs, birds etc.)

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HABITAT IS HOME

7. Instruct the class to look at Picture 2 and lead a discussion about what's happening. Explain that many plants and animals lose their homes when people cut down forests. Ask them which of the smaller pictures show reasons why people cut down forests. (for lumber and firewood and to clear land for farms and roads). Have students link Picture 2 to the smaller pictures. Can they think of some animals that live in forests? (deer, rabbits, snakes, squirrels, birds, etc).
8. Instruct the class to look at Picture 3. Explain that when a dam is put across a river, a deep lake forms, changing the animals' river habitat. Have students connect Picture 3 to the reasons people put in dams (to make electricity in power plants and to create lakes for recreation). What animals can they think of that live in or near rivers? (fish, bears, beavers, etc.).

Discussion Questions:

1. Can you think of any other ways people change habitats?

   List suggestions on the board. Possible answers include: mining operations; overgrazing by livestock; driving off-road vehicles; walking off designated trails; polluting, etc. Point out that people need to grow food, build houses, and so on, but that sometimes we make too many changes in an area and create problems for the plants and animals that live there.

2. Can you think of ways people sometimes change an ocean habitat so it becomes a worse place for plants and animals to live?

   List these suggestions on the chalkboard as well. Discuss such things as oil spills, sewage and runoff pollution (such as fertilizers and pesticides), and trash that entangles animals (such as discarded nets and plastic rings from beverage can six-packs).

3. Which of the problems on the lists could be prevented?
4. What are some other ways we can help save habitats, or avoid destroying them?

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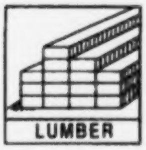
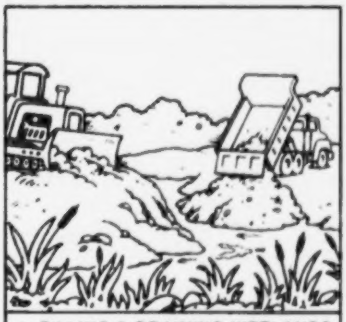
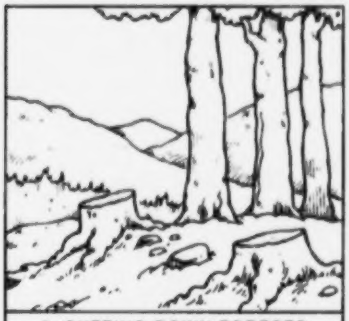
HABITAT IS HOME

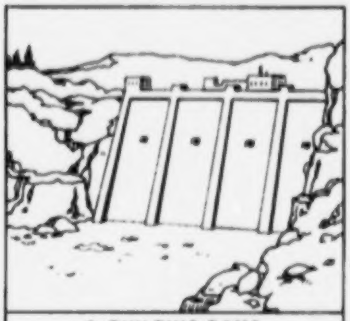

LUMBER

LAKES

ROADS


1. FILLING & DRAINING WETLANDS


2. CUTTING DOWN FORESTS


3. BUILDING DAMS

FARMS

FIREWOOD

ELECTRICITY

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PONDERING PANDAS

ACTIVITY 40

PONDERING PANDAS

Materials:

World map or globe
Construction paper
Can of bamboo shoots
Articles about giant pandas and their habitat such as *National Geographic* magazine, February 1993, March 1986 and December 1981 (optional)

Procedure:

1. Tell your students that they are going on an imaginary trip with you to learn more about an endangered species, giant pandas. If available, show students a picture of a giant panda from a past issue of *National Geographic* or an encyclopedia. On a map or globe, help students identify the location of China, home to the giant pandas.
2. Explain that bamboo shoots growing in springtime are a favorite food of pandas. Bring in a can of bamboo shoots for the students to taste, and inform the students that an adult panda may eat as much as 85 pounds of bamboo shoots a day. Given that figure, ask students to calculate how many cans of bamboo shoots they would need to feed an adult panda for a day, a week, or a month. Have students make "bamboo" from tubes of construction paper and cut-out leaves, or simply cut paper to represent bamboo. Remind them that bamboo is the main food pandas depend on for survival.
3. The following activity simulates human population pressures on the habitat of the giant panda. The activity is based on a classroom with 30 desks and 25 students, but may be adapted as long as there are a few more desks than there are students. Arrange the classroom desks in five rows of six, with equal space around the desks. Tell students to stand in a circle around the desks. Place several pieces of the students' homemade bamboo on each desk.
4. Assign five students to be pandas. Younger students may wear masks to help them play the role. Tell the "pandas" that the desks represent their bamboo forest and that they may roam from one bamboo stand to another in any direction, but never across open land (a desk with no bamboo). After a short time, ask each panda to stop, pick a desk, and browse there.

Concept: Human population pressures destroy many animal habitats including that of the giant panda in China.

Objective: A simulation of pandas in the wild relays to students the needs of the panda and the impact of human population increase on its natural habitat.

Grade Level: Lower and upper elementary

Subjects: Social studies, science, language arts, math

Skills: Observing, role playing, researching

Introduction: The giant panda is one of the best loved members of the animal kingdom, and yet the species is close to extinction. This activity will help students understand one of the major threats to the panda's survival—loss of habitat. The pandas, native to China, share their land with 1.2 billion people. This simulation illustrates what happens when both people and animals struggle to meet their basic needs. Students should keep in mind that the plight of the giant panda is shared by many other species in every part of the globe.

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PONDERING PANDAS

5. Now ask five other students to claim one desk each as their territory for farming. They will remove the bamboo (a process known as clear-cutting) because they will need that area for housing and agriculture. Now tell the pandas to move to a new, adjacent stand of bamboo. Discuss with the students whether the panda's access to new bamboo was affected.
6. Introduce successive groups of five students to claim farms, each time allowing pandas to move to adjacent stands, until all "farmers" have claimed territory. Finally ask the pandas which of them can still reach another stand of bamboo.

The class will find that some pandas are isolated from new food. Others may be restricted in some directions from reaching new food. (Note: Availability of food is only one problem resulting from destruction of habitat. As small groups of pandas are isolated, inbreeding also becomes a problem.)

Discussion Questions:

Explain to the students that the pandas' home, China, is also home to 1.2 billion people, more than one-fifth of the world's population, but is only about the size of the United States. It is estimated that by the year 2020, 1.5 billion people will live there. As China's population continues to grow, more and more people will need a place to live, grow food, build factories, schools and so on. Because the land is so densely populated, open spaces and fields will disappear, and people will resort to cutting down the forests which are home to the giant pandas.

1. What is unique about the panda habitat and why is it in danger?
2. If the pandas have no more food and shelter, what will happen to them?
3. Ask students to propose solutions to the pandas' predicament.

Follow-up Activity:

The giant panda is one of the world's best-known endangered species. Invite students to write a brief report on another famous endangered species such as Asian or African elephants, Bengal tigers, koala bears, whales, mountain gorillas, etc. The report should answer the following questions:

Where is the animal's habitat?

What does the animal eat?

Why is the animal endangered?

Are there steps people can take to save the animal from becoming extinct?

Adapted with permission from the National Geographic Society as it appeared in *Geography Education Program Update*, ©1992.

WANTED ALIVE

ACTIVITY 41

WANTED ALIVE

Materials:

Brown paper grocery bags
Aluminum foil
Colored markers, pencils, crayons
Copies of the WANTED ALIVE poster for each student
Listing of your state's endangered species from your local conservation district office or fish and wildlife agency

Procedure:

1. Get a list of endangered animals and plants in your geographical area by contacting your state's fish and wildlife agency or local conservation district.
2. Go over with students the following reasons why species are endangered or threatened:
    a. **Loss of habitat:** Human numbers and activities have caused the loss and destruction of millions of acres of prime habitat. Many plants and animals find themselves homeless as a rapidly growing human population scrambles to meet its basic needs for food, water, fuel and shelter.

    b. **Pollution (air and water):** Acid rain, toxic chemical dumping and plastic garbage threaten or kill plants and animals.

    c. **Poaching/illegal trading/illegal harvest:** People killing plants and animals for money.

    d. **Overhunting and overfishing:** Catching so many animals or fish that the population cannot replenish itself.

    e. **Predator control:** Some people believe that predators, such as wolves and cougars, kill too many livestock, fish and game. So the people kill the predators.

    f. **Poisons:** Herbicides and pesticides kill many nonpest plants and animals.

    g. **New species introduced to the wild which kill off the old species:** Exotic or nonnative species compete with native plants and animals for food, water and shelter.

    h. **In the wrong place at the wrong time** (road and boat kills, etc.)

Note: Most species are in trouble due to more than just one problem. Many are threatened or endangered due to a complex combination of factors.

Concept: Wildlife preservation is worth fighting for, and each of us can become a spokesperson for an endangered species.

Objective: After being deputized, "Species Sheriffs," students will research an endangered species and create a poster defending the species' right to be saved.

Grade Level: Lower and upper elementary

Subjects: Science, art

Skills: Researching, writing, analyzing information, drawing

Introduction: Historically, ever since the Pilgrims landed at Plymouth Rock and the pioneers in their covered wagons began to settle in the West, the *real* "wild" West began to disappear. As more people began to inhabit every part of this country, many plants and animals that lived throughout the land died as people hunted them and cleared trees and wild plants. More than 500 species have become extinct, never to return.

Extinction has always been a natural phenomenon with one species dying off every 1,000 years. However, the current rate of extinction is one species per day! The leading cause is human population growth, which destroys more and more species' habitat. Scientists estimate that the Earth is now losing more species to extinction in one week than all species lost on the planet in the past 300 years.

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WANTED ALIVE

2. Tell your students that you are deputizing them "Species Sheriffs" to protect threatened and endangered plants and animals. Ceremoniously pin an official sheriff's badge onto each deputy's "rawhide vest." Use the star badge pattern provided. Trace onto cardboard, cut out and cover with foil. The Western vest can be cut from a grocery bag. Use recycled brown paper bags that are already "tanned." You may want to add fringe or fancy stitching.

3. Have each sheriff choose a different plant or animal from your state's current list of endangered species. Students will immediately go for the "warm and fuzzies," but encourage them to research the plants and invertebrates.

4. Ask your sheriffs to research their species' Latin names and habitats. Have them also find the answers to the following questions:

   Why is this species endangered or threatened?

   What are the human population projections in your state?

   What is being done to help this species?

   What can you do to help this species?

   Why should this species be saved?

The answers to the last question may include the following reasons:

Ethics: Higher intelligence does not justify the willful extermination of other species.

Respect: Every plant and animal has intrinsic value.

Genetic Diversity: Every plant and animal is unique. If we lose one species, we have lost a model that can never be replaced; nature's storehouse of genetic variation is necessary for the survival of all species.

Balance of nature: Interdependence and interconnection.

Science: Uses in medicine and industry.

Agriculture: Expansion of food production.

5. For a fun way to sum up their reports, ask your sheriffs to create a Wild West WANTED poster for their endangered species. Photocopy the poster border for each student. Have sheriffs draw or cut out a picture of their endangered plant or animal, placing it below the title, "WANTED".

6. Beneath the picture of the endangered species, sheriffs write the species' common and Latin names. This is followed by brief highlights (facts and figures) from their reports, starting with their reason why this species is WANTED ALIVE!

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WANTED ALIVE

6. To "age" the poster and make it appear a bit more rustic, the edges can be cut ragged, yellowed with boot polish and "burnt" with pencil lead or black marker.
7. Cover classroom walls with burlap or other rough and rustic fabric. Invite your sheriffs to publicly speak on their species and post their WANTED ALIVE signs. This could be a school-wide event too.

Follow-up Activity:

Encourage students' political activism on species preservation. Have them send copies of their posters along with a letter to their local Congressional representative and two state senators. Remind students to keep their letters polite and positive.

Representative
U.S. House of Representatives
Washington, DC 20515

Senator
U.S. Senate
Washington, DC 20510

Adapted by permission from Sheila B. Jones, Conservation Education Specialist, Wake Soil and Water Conservation District, Raleigh, NC as printed in *The Conservation Catalyst Newsletter*, ©1994.

WANTED

~~DEAD OR~~ ALIVE

COUNTING ON PEOPLE

JUST FOR KIDS

BEST COPY AVAILABLE

ANSWERS

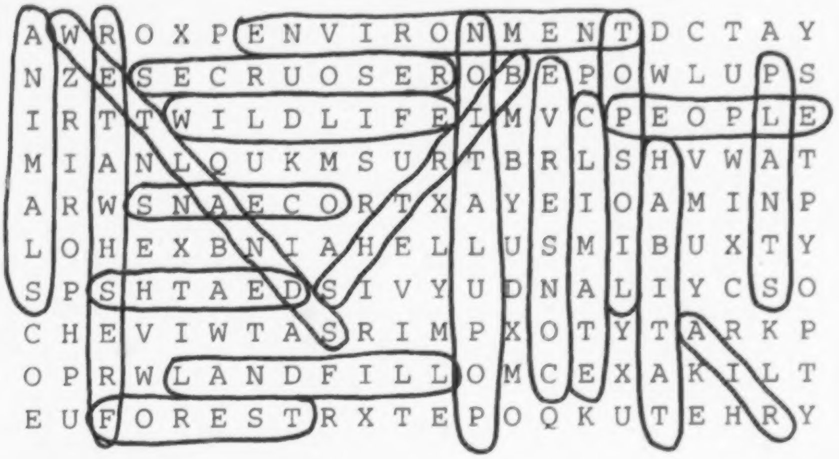
The following pages contain word games to reinforce the vocabulary and concepts used throughout the kit. Reproduce these for your students for class time or homework.

Answers to Word Games:

Environmental Scramble

Population, Pollution, Trees, Wetlands, Habitat, Garbage, Recycle, Energy, Rainforest, Automobiles, Sharing, Cooperation, Crowds, Census, Resources

Population Word Search



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A W R O X P E N V I R O N M E N T D C T A Y
N Z E S E C R U O S E R O B E P O W L U P S
I R T T W I L D L I F E I M V C P E O P L E
M I A N L Q U K M S U R T B R L S H V W A T
A R W S N A E C O R T X A Y E I O A M I N P
L O H E X B N I A H E L L U S M I B U X T Y
S P S H T A E D S I V Y U D N A L I Y C S O
C H E V I W T A S R I M P X O T Y T A R K P
O P R W L A N D F I L L O M C E X A K I L T
E U F O R E S T R X T E P O Q K U T E H R Y
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Break the Code!

Habitat, Water, Clean Air, Wildlife, Forest, Oceans, Topsoil, Landfill, Minerals, People

Rebus Resolution

More people live on Earth today than at any time in history. But the Earth is not any bigger than it used to be. Let's treat our planet well!

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ENVIRONMENTAL SCRAMBLE

Below you will find scrambled words and their definitions. Unscramble the letters of the word and write it on the line in the right-hand column. To help, the first letter of each word has been underlined for you.

LOTPPAINUO	The whole number of people, animals or plants in a given region	1 ________
TOPLNULIO	Dirt that fills our air and water from people's use of resources	2 ________
ESTER	These provide us with beauty, shade, and clean the air	3. ________
DLWEASTN	This is the habitat for many water-fowl and plants	4. ________
ATBTHIA	Home to plants, animals and people	5. ________
REGAAGB	This is what we throw out — 4 lbs. per day in the U.S.	6. ________
CLERCEY	Taking used materials such as glass, paper and plastic and using them in other ways	7. ________
GREENY	We use this every day to heat our homes, cook our food and power our cars	8. ________
RSEFARSNIOT	These are found in tropical areas and are home to most of the world's plant and animal species	9. ________
OBTULIEAMOS	Much of our open land has been paved to make room for these	10. ________
GRAHSNI	We need to do this with our resources so that all people can have a better way of life	11. ________
RACOPNOETIO	Working together to share resources and to get along with others	12. ________
DCWORS	Lots of people in a confined place	13. ________
SCUNSE	A count of people to determine the population size	14. ________
OSRRCUESE	Basic things that everyone needs to live, such as trees, water and minerals	15. ________

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POPULATION WORD SEARCH

The human population is connected with many other things. How many can you find in this word search? Words go down, up, across, backwards and diagonally. Use the word list for help.

Population
Births
Deaths
Environment
Resources
Climate
Forest
Animals
Topsoil
Wetlands

People
Landfill
Conserve
Oceans
Freshwater
Air
Habitat
Wildlife
Plants

A W R O X P E N V I R O N M E N T D C T A Y

N Z E S E C R U O S E R O B E P O W L U P S

I R T T W I L D L I F E I M V C P E O P L E

M I A N L Q U K M S U R T B R L S H V W A T

A R W S N A E C O R T X A Y E I O A M I N P

L O H E X B N I A H E L L U S M I B U X T Y

S P S H T A E D S I V Y U D N A L I Y C S O

C H E V I W T A S R I M P X O T Y T A R K P

O P R W L A N D F I L L O M C E X A K I L T

E U F O R E S T R X T E P O Q K U T E H R Y

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BREAK THE CODE!

What word means the same thing as each definition below? See if you can guess. Then use the decoder below to translate the funny-looking answer at the right.

A place where people or animals live	8 1 2 9 20 1 20
Something every living thing needs to survive	23 1 20 5 18
What we need to breathe, in order to stay healthy	3 12 5 1 14 1 9 18
Plants and animals in nature	23 9 12 4 12 9 6 5
A place where there are many trees	6 15 18 5 19 20
These contain most of the water on Earth	15 3 5 1 14 19
The top layer of the Earth, where we grow our food	20 15 16 19 15 9 12
A place where trash is buried under layers of earth	12 1 14 4 6 9 12 12
Resources taken from the ground, such as gold and iron	13 9 14 5 18 1 12 19
The ones who make up the human population	16 5 15 16 12 5

Decoder:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R

19	20	21	22	23	24	25	26
S	T	U	V	W	X	Y	Z

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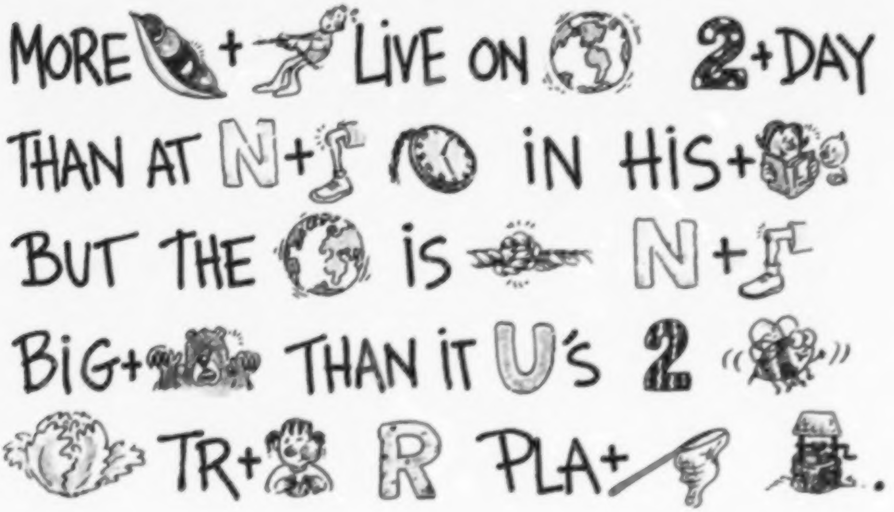
REBUS RESOLUTION

There's a message hidden in the code below. Sound out the letters and pictures to find out what it says.



Message: ____

____

____

____

____

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APPENDICES

COUNTING ON

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GLOSSARY OF TERMS

The following terms have been indicated in **bold** throughout the kit activities and chapter introductions.

biotic potential: the ability of a species to increase its numbers through reproduction.

carrying capacity: the maximum size of a population that can be supported by the resources of a specific area.

census: a periodic count of the population, usually taken by the government.

crop rotation: growing a different crop in each section of a farm and then rotating the placement of each crop from year to year. This maintains needed nutrients in the soil to keep the land fertile.

deforestation: cutting down forests.

emigration: leaving a place or country to live somewhere else.

exponential growth: a constant rate of growth applied to an ever-increasing base.

export: a product that one country sells to another country.

extinct: no longer existing. When a species of a plant or animal dies off, we say that it is extinct.

habitat: the place or type of site where an animal or plant naturally lives and grows.

immigration: coming into a place or country to live, where one is not a native.

import: a product which one country buys from another country.

poaching: taking or killing animals from the wild illegally.

population: a group of living things (people, plants, animals) living in a particular area.

nonrenewable resource: a resource from the Earth in a limited supply which cannot be regenerated, such as a mineral.

recyclable: able to be recycled. Paper, glass, metal and plastic are examples of materials which can be used and then recycled, or made into new products.

renewable resource: a resource from the Earth which can be regenerated, such as trees which are planted to produce more trees over time.

topographical map: a map which shows the natural and man-made features of the land including mountains, rivers, lakes, forests and deserts.

wetland: land containing a lot of soil moisture; a swamp, marsh, etc..

zero population growth: when a population is stable, neither growing nor decreasing. When births plus immigration is equal to the number of deaths plus emigration, we say that a population has reached zero population growth.

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ZPG POPULATION EDUCATION MATERIALS

Counting on People: Elementary Population and Environmental Activities (for grades 1-6)

ZPG's newest teaching kit, *Counting on People* offers a wide variety of hands-on classroom activities for younger students. Population and environmental concepts are presented in fun, interesting ways so that even the very young can understand them. Students plant seeds and see how they grow, simulate cougars in the wild looking for food, conduct a census and hone their problem-solving skills as they learn about population-related concepts such as cooperation, sharing, conservation and family tradition. Includes over 40 hands-on activities plus memorable poems, songs and stories. #ELMN $19.95.

Earth Matters: Studies for Our Global Future (for grades 9-12)

ZPG's most comprehensive kit! This spiral-bound book of 12 student readings and 32 innovative activities covers such topics as deforestation, global warming, hunger, poverty and the status of women. *Earth Matters* also examines the underlying clashes between economic growth and environmental health. Activities include simulations, debates, lab experiments, critical thinking exercises, problem-solving challenges and a rainforest board game. Received the highest rating of environmental kits about human communities from the California Department of Education and the California Energy Commission! #EMTT $19.95.

For Earth's Sake: Lessons in Population and the Environment (for grades 6-10)

Introduce students to the remarkable interconnectedness of people and the environment with this kit, including student reading material, 17 hands-on activity modules, teacher's guide, resource list, data sheet and 150 concrete suggestions for "making a difference." Guaranteed to increase students' understanding of important population and environmental concepts and promote a sense of individual stewardship of the Earth. #FRER $19.95.

Multiplying People, Dividing Resources: A Math Activities Kit (for grades 5-10)

Math has never been as fun and eye-opening as with this new kit of activities which make critical connections between people, resources and the environment. Now students can use real world population and environmental data to practice working with large numbers, percentages, ratios and growth curves in analyzing the world around them. All of the activities are consistent with the goals of the new standards of the National Council of Teachers of Mathematics. Each kit contains 19 hands-on math activities, a World Population Data Sheet and ZPG's guide to *Computer Software for Population Education*. #MATH $9.95.

EdVentures in Population Education (for grades 4-12)

A perfect way to introduce students to basic population concepts. Includes 16 hands-on classroom activities: simulations, games, decision-making challenges, and other group activities which make abstract concepts concrete and understandable and give your classroom an air of excitement about learning. Kit also includes valuable background resources: data sheets, resource list, etc. #EDVN $19.95.

USA by Numbers Teaching Kit (for grades 9-12)

Bring home the relevance of population studies by inviting students to discover what is happening in the USA! This kit is based on and includes ZPG's reference book, *USA by Numbers*, compiling current and historic data on U.S. demographics, socioeconomic and environmental trends from A(acid) to Z(zero population growth). Fourteen classroom activity modules guide your students through analysis of this fascinating collection of information. #USAT $19.95.

"World Population" Video (for all grade levels)

Educators agree that *World Population* is the best-ever simulation of human population growth. As the years roll by on a digital clock from 1 A.D. to 2020, dots light up on a world map to represent millions of people added to the population. Historic references on the screen place population changes in context. This 6 ½ minute videocassette includes a 12-page activity and discussion guide, including a Spanish translation of the video's narration. "The impact of this short video is astounding," writes *The American Biology Teacher*. "It will be a valuable asset to any school's audio-visual library." #WPPV $29.95.

Computer Software for Population Education (for all grade levels)

ZPG's comprehensive review helps teachers find the programs most suited to their needs. Nearly 40 software programs for all grade levels are reviewed, including mathematical models, simulations, data bases and problem-solving games. Each review includes price and ordering information, as well as hardware compatibility for each software package. #PPSF $1.95.

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ZPG POPULATION EDUCATION MATERIALS

Selected Resources on Population

This comprehensive bibliography of information sources related to population and the environment includes books, bulletins, software, films and teaching materials. Included in ZPG's teaching kit *For Earth's Sake: Lessons in Population and the Environment*, this listing is also available separately. #SLCT $1.25.

Teaching Population: Which Textbook to Choose?

Learn which science textbooks provide adequate coverage of population dynamics and impacts in ZPG's report. Over 40 life science, biology and environmental science textbooks from 17 different publishers are included in this study. Each textbook is rated on an easy-to-read matrix which indicates how the book addresses general population information, projections for the future and the link between population growth, resource depletion and environmental quality. #TEXT FREE.

Who's Covering Population in the Social Studies?

ZPG's newest textbook survey evaluates 30 secondary social studies texts for geography, global studies and world history to assess their coverage of population topics. Use our handy charts and reviews to help select your next textbook. #TEX1 FREE.

Actividades para Educación sobre Población (for all grade levels)

To meet the needs of classrooms in Latin America and bilingual classes in the U.S., ZPG offer seven of its most popular teaching activities translated into Spanish. The motivational activities include simulations, games, problem-solving challenges, a quiz, riddles and a discussion guide to ZPG's dramatic video, *World Population*. #SPAN FREE.

Teachers' PET Term Paper (for all grades)

This lively quarterly newsletter for teachers involved in K-12 population education features student activities and reviews of books, audiovisuals, software and curricula. #TCHR $3.00 for one-year subscription.

Readings on Overpopulation (for grades 6-12)

This collection of recent ZPG articles examines the various aspects of continued population growth. Topics include: traffic congestion, loss of forests and wildlife, the garbage crisis, global warming and food shortages. #ENVR FREE.

ZPG Population Education Training Workshops for Teachers

ZPG offers population education training workshops through inservice programs and teacher education programs throughout the country. Since 1975, thousands of educators have participated in these workshops, and millions of young people have benefitted from population studies as a result.

Population education helps students appreciate the interdependence of people, natural resources, food, industry and land. They learn not only about the social, political and environmental impacts of population growth and change, but more importantly, how their own personal decisions will affect the quality of life in tomorrow's world.

ZPG workshops present current information on world and U.S. population trends and their impacts and demonstrate a variety of teaching strategies designed to actively involve students in the learning process: films, games, quizzes, simulations and other thought-provoking exercises. Workshop participants receive complimentary teaching materials to support their population education efforts: current population statistics, scripts for classroom activities, resource lists and reference guides. They also receive follow-up assistance through a quarterly newsletter, phone contacts and correspondence.

Workshop length and content are tailored to the professional needs of the participants. Some are as short as an hour, others as long as a full day. Some are geared toward a specified audience, e.g., high school social studies educators, middle school life science teachers or elementary school teachers; others are open to teachers of all subjects in grades K-12.

Because ZPG is a nonprofit organization with a limited budget, we ask education agencies sponsoring our workshops to cover travel expenses and provide a modest honorarium. For further information, or to arrange a ZPG population education workshop, contact:

ZPG Population Education Program
1400 16th Street, N.W., Suite 320
Washington, DC 20036
Phone: (202) 332-2200
Fax: (202) 332-2302
E-mail zpg@igc.apc.org

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	Computer Software for Population Education (PPSF)	$ 1.95	
	Counting on People Kit (ELMN)	$19.95	
	Earth Matters: Studies for Our Global Future (EMTT)	$19.95	
	EdVentures in Population Education (EDVN)	$19.95	
	For Earth's Sake: Lessons in Population and the Environment(FRER)	$19.95	
	Multiplying People, Dividing Resources: A Math Activities Kit (MATH)	$ 9.95	
	Readings on Overpopulation (ENVR)	FREE	
	Selected Resources on Population (SLCT)	$ 1.25	
	Teachers' PET Term Paper (1 year) (TCHR)	$ 3.00	
	Teaching Population: Which Textbook to Choose? (TEXT)	FREE	
	USA by Numbers Teaching Kit (USAT)	$19.95	
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COUNTING ON

IT'S TIME FOR COUNTING ON PEOPLE!

Counting on People is more than just an environmental education curriculum for young students, it is an exploratory guide to help them understand their connections to other people, all living things and the world that sustains them. This unforgettable book of innovative teaching activities, delightful poems and songs and charming illustrations is a must for any elementary classroom. It not only serves as a primer on population dynamics and environmental impacts, but also fosters respect for the needs of others and stresses the importance of using cooperative strategies to promote a high quality of life for all that share our planet.

Here's a glimpse of the more than 40 fun, interdisciplinary activities that make lasting impressions:

- ☐ **Popumonsters...**Do the "millipede stampede" to show the cooperation needed for a group to move as one. More fun than a Conga line!
- ☐ **Fruit Fly Frenzy...** How *do* populations grow? Set up a simple fruit fly lab in the classroom and let students observe the swift multiplication.
- ☐ **Pondering Pandas...**What happens when panda habitat becomes human habitat? Help guide students through a simulation as they look for enough bamboo to stay alive.
- ☐ **Every Drop Counts...**Once students see how precious water is through these simple activities, they will understand why we need to conserve this resource.
- ☐ **Family Roots...** Why do people migrate from one area to another? Students explore their own family roots and interview friends, family and neighbors to better understand the forces compelling people to migrate.

Plus... Sing ditties from Pete Seeger and *Sesame Street*, write poems about trees, turn trash into art supplies, take on the challenges of tricky word games and much, much more! Just open the book and look inside.

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